THE GARDENER'S ASSISTANT

WILLIAM WATSON

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ONIONS

Back row (from left to right): Ailsa Craig, A1, Sutton's Globe. Front row (from left to right): Crimson Globe, White Spanish, Blood-red

THE GARDENER'S ASSISTANT

Editor

WILLIAM WATSON

F.R.Hort.S.

Curator, Royal Botanic Gardens, Kew

With Preface by

PROFESSOR SIR FREDERICK W. KEEBLE

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VOLUME I

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THE GARDENER'S ASSISTANT. Editor, WILLIAM WATSON, F.R.Hort.S., Curator, Royal Botanic Gardens, Kew. With Preface by Professor SIR FREDERICK W. KEEBLE, C.B.E., F.R.S., Sc.D.(Cantab.), and many specialist contributions. Published 1925.

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PREFACE

It is not usual, nor as a rule desirable, for the writer of a preface to descant on the excellence of the book which he introduces to the public. Rather is it his duty to describe the purpose and plan of the work, interspersing his description with judicially worded praise of the manner in which purpose and plan have been fulfilled. In the present case, however, there are good reasons why this generally salutary practice should be ignored. One of the reasons is that, inasmuch as I am a gardener not by profession, but only by predilection, I cannot but welcome the opportunity of paying a tribute to the skill and knowledge possessed by British professional gardeners. Evidence of that knowledge is forthcoming in wellnigh every page of this work: for wellnigh every page is from the pen of one of the leaders of the world of professional gardeners. The names of the contributors are a sure warrant of the trustworthiness of the information which these writers severally impart: Edwin Beckett on Kitchen and Fruit and Vegetable Gardens, James Hudson on Fruits and the Orchard House, Ward on Vines, O'Brien on Orchids, Webster on Bedding and Sub-tropical Gardens, Lynch on Herbaceous Perennials and Hardy Annuals, Bean on Transplanting, and other names no less distinguished—all of men to whom anyone wanting information on one or other of these subjects has been wont to turn. In these pages they give their ripe experience to the world, and so hand on to posterity the knowledge which has made them famous among their contemporaries, and thereby ensure that the lore, which by much and arduous labour they have acquired, shall live after them.

There are yet other reasons why the writer of the preface should not hesitate to express his admiration for this work. It is and has long been famous. The first edition edited by a great gardener, Robert Thompson of the Horticultural Society's Gardens at Chiswick, appeared in 1859, and from that day to the present time, *The Gardener's Assistant* has been the guide, philosopher, and friend of British gardeners.

After some forty years Thompson's original edition, which so well proved itself, was replaced by another; edited by a young but already well-known gardener, William Watson. The success which attended the first attended also this edition. Nor could it well have been otherwise, for the editor had a keen eye not only for plants but for capable men, and gathered round him the best gardeners of his time. Many of those named already are still the best, and after a lapse of twenty-five years are contributing again to the present edition: a guarantee that it will merit and receive the same encomium as that which was bestowed upon its predecessor, and will like it be regarded as "the soundest and best guide to practical gardening published in our times: the best book on general practical horticulture in the English language".

Yet a third and most cogent reason why in writing the preface I should speak in terms of praise of this work is that this is the only thing which, though I may essay it, the editor himself, had he lived, neither could nor would have done. Whilst the last pages of this work were in the press, the hand of death was laid on William Watson, and it is an added sorrow to his friends that the editor did not live to see the issue of a work on which he had spent such an infinity of time, trouble, and solicitude.

Watson was a great gardener. He had an unrivalled knowledge of plants, and none knew better how to cultivate them. It was in 1879 that he went to Kew, where he rose to the position of Curator, from which post he retired so recently as 1922. This is not the place to write of Watson's many attainments. Those who would learn them may find in the *Gardener's Chronicle* for 15th July, 1922, an account of his career and activities, written by his friend and colleague, Sir Frederick W. Moore. It is, however, the place to state that in the preparation of this work Watson gave of the very best that was in him. He brought to the task a wide knowledge of plants and a profound love of them. During the years that he laboured at Kew, discovery added many and great riches to Horticulture. Successive explorers brought home botanical and garden treasures from China and Thibet, and other parts of the world. Science contributed great stores of new knowledge, on the one hand revealing to the gardener the intricate and amazing properties of the soils with which he works, and on the other hand making plain some at all events of the laws of heredity which plants obey. With the profusion of gifts it was inevitable that some confusion should come also. Hybrids between varieties and species, increasing each year, though

they may add to the beauty and interest of gardens, add also to the difficulty of the young gardener who desires, as every gardener should, to " know his plants ".

To sort out, describe, and appraise all this new wealth of knowledge is a task which no one who had not at once a wide knowledge of Horticulture and a deep love of it could have undertaken with success. Watson had both, and the success which he has achieved will make of this work an enduring memorial of his greatness as a gardener. It is right, therefore, that this book should be known by his name. It is true that Thompson laid the foundations of it: but it is no less true that Watson has rebuilt it, incorporating with skilled hands the new knowledge with the old, and adding ornament in the form of coloured illustration which augments not only the beauty, but also the usefulness of the work: therefore, over the portals of this treasury of Horticulture, his name is inscribed.

FREDERICK KEEBLE.

CONTRIBUTORS

The following are the chief contributors to the 1925 edition of "The Gardener's Assistant", with a note of the main subjects dealt with by them severally.

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E. MASON: Garden Structures.

PROFESSOR DICKSON: Meteorology.

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THE GARDENER'S ASSISTANT

VOLUME I

THE FRUIT AND VEGETABLE GARDEN

FORMATION

The principal points to be considered in the formation of the Fruit and Vegetable Garden, popularly called the Kitchen Garden, are—1. SITE. 2. SOIL. 3. SIZE. 4. FORM. 5. SHELTER.

1. SITE.—The ground should either be level or slope gently to the south, south-east, or south-west. If level, it should not be so low as to prevent proper drainage. A slope to the east of south, or so as to face the sun at about eleven o'clock in the forenoon is to be preferred. Steep slopes should be avoided, especially in parts of the country where the annual rainfall does not exceed an average of 24 inches, where the ground selected should either be level, or not sloping more than 1 foot in 50. In wet climates a fall of 1 foot in 30 may be advantageous for early crops; but for walled-in gardens such steep slopes are inconvenient. The lower part of a slope is the best situation, as there the soil is generally of good quality, owing to the washing down of the richer parts from the higher ground, and the greatest benefit is derived from the rays of the sun. A flat, low-lying situation should be avoided, as the subsoil will probably be damp and sour, and it cannot be easily drained. Hoar-frost also may be frequent, and it often proves ruinous to the crops.

An excellent form of garden is one with a regular declivity from north to south, in which direction a walk divides the area into two equal portions, each of which slopes uniformly from the side inwards to the central walk. The garden is thus generally inclined to the south, whilst the one half has an eastern inclination, the other a western. In this way the sun's rays have greater effect, and water runs off freely, but not too rapidly. If the ground was level from north to south, and sloped only from the sides to the central walk, then the water would naturally run direct from the sides towards the walk; but when the ground likewise slopes from north to south, the water will follow a diagonal course, and will be much more effective in refreshing the crops.

Usually the front of a country mansion faces the south; but whatever its direction may be, the ground usually slopes from it. This position would be much too conspicuous for the kitchen garden, and it could not be easily screened. The north or reverse side of the mansion generally trends upwards in the view, and in such circumstances an eligible site for a garden is not often found in that quarter, or at a higher elevation than the mansion. A position in an easterly or a westerly direction from the mansion is more generally available, and it is undoubtedly preferable.

In whatever direction the garden may be placed, it should be effectually masked from view from the principal windows and front of the mansion either by natural undulations of the ground or by plantations of trees and shrubs. It should also be screened from view from the pleasure-grounds by the same means, as well as from the main carriage-drives. The distance at which it may be placed must depend upon the size of the mansion and the extent of the surrounding pleasure-grounds. Where these are extensive, the garden may require to be situated a quarter of a mile or more from the mansion, but a shorter distance is desirable.

Fig. 1 is a plan showing the position of the kitchen garden in relation to the house and other parts of the garden.

If the kitchen garden is situated directly south from the mansion it cannot be entered without the first view being among the most uninviting in the whole garden, that of sheds and other buildings behind the glass structures, which are generally of such a description as should be concealed as much as possible. If situated to the north, such an objection does not arise, the houses being

Fig. 1.

then approached directly in front. But on the other hand, when the kitchen garden is north of the house, it can rarely be screened by means of plantations of trees without sacrificing a considerable portion of light. If, however, the site is either on the east or west side of the mansion, these objections will not apply; neither will they if the situation is in a south-east or south-west direction from the mansion.

Generally a position on the east side is to be preferred, especially where the contour of the ground requires artificial shelter to be formed against the north and north-east winds. Supposing the ground to be level, and the garden placed to the south-west, then to shelter it from the north and north-east winds, high trees at some distance, as they ought to be from the garden, would certainly interfere with the pleasure-grounds; whereas, if the garden is placed on the east side, the necessary shelter would be farther from the mansion than the garden itself, and therefore would not come within the space required for ornamental purposes.

2. Soil.—The nature of the soil in a garden is of primary importance, although in the first instance it may be subordinate to the site and exposure, which when once fixed are intended to be permanent. Soil, on the other hand, can be altered and improved to suit the crops at the pleasure of the owner, and at a comparatively small cost. The best soil for a kitchen garden a good sound loam of a slightly calcareous nature, or a sandy loam mixed with certain proportions of lime and humus to render it fertile. The former is most suitable for the growth of fruit trees, while the latter is more desirable for early crops of vegetables. A light, free soil is also more amenable to cultivation in all states of the weather, and

under proper treatment is as productive as a heavier loam. While the greater part of the vegetable quarters should therefore be composed of a rich, light, friable loam, it would be advisable in most cases to have a portion of a stronger texture for crops that thrive best in a strong soil.

The depth of good soil for a fruit and vegetable garden should be 3 to 3½ feet, to which depth it should be thoroughly drained. Generally speaking, far too much importance is attached to the nature of the subsoil. After a kitchen garden has been decided upon it will in all probability remain one for centuries, therefore extra care should be taken in the first instance, and wherever practicable to trench it to a depth at least 3½ feet, bringing the subsoil to the surface. Then by retrenching annually and adding stable manure the whole depth of the soil will be brought into a fertile condition in a very few years, whereas, if the old method is adapted, that is, religiously keeping the whole of the surface soil to the top, this can never be satisfactorily accomplished. In no case should the soil be less than 18 inches in depth.

The subsoil should also be carefully examined, for if it is sour and bad, or contains too much iron, a site should be sought for elsewhere, however suitable the top-soil may be. When the surface soil is good, the crops may grow well for several years, or till their roots penetrate into the bad subsoil, and then exhibit symptoms of decay.

The choice of site is affected by three considerations: the quality of the soil itself, the nature of the subsoil, and the position with reference to the mansion, as already indicated. It may fortunately happen that a good soil and subsoil exist in the most desirable situation, and when this is the case the matter of course is easily settled. But the situation and subsoil may be good, whilst the top-soil is bad, when it may be a question whether the two good qualities should not be taken advantage of, and the top-soil improved.

If the top-soil is too thin, the necessary thickness may be made up by the introduction of proper soil from other places where it can be spared. The good surface soil thrown out in digging for the foundations of walls or other buildings, and for the bottoms of walks, should be economized for the purpose. A rich old pasture affords excellent garden soil, and it should be removed in the manner that will do the least injury to the field. If the entire surface is removed from, say, half the field, that half in most instances would not soon recover. But if the whole surface is lined off in strips, say 15 inches wide, and only every other one taken off a spit deep for the garden, and the field be well manured and trenched across the strips, it will soon recover its loss, which, in fact, by this mode will be scarcely apparent a year afterwards under good management; whereas, the effects of the removal of the entire surface would be plainly visible under the best of treatment for years.

The area of the garden being known, less that of the walks, and the depth of soil required to be added being also ascertained, the number of cubic yards to be brought in can easily be calculated, and estimated for. It then becomes simply a question of expense, as to whether the garden can be formed in the best situation and on a good subsoil or not. It should be borne in mind that pleasure-grounds can be laid out, and altered, if this should prove desirable; but such is not the case with a fruit and kitchen garden surrounded by walls and furnished with numerous structures. Therefore, it is most desirable to have it established in the best situation, even at some considerable expense for soil in the first instance. Rather than it should not be so placed, a portion of the ground, say a half or one-fourth, including borders and where trees are to be planted, could be done in the first instance; and soil could be collected for making good successive portions till the whole was completed.

Where the subsoil is at fault, the remedy is more difficult. If only some portions of it are bad, these may be removed and a better kind substituted. When too much iron is present in the subsoil, the latter may in certain cases be overlaid with concrete, lime, or chalk, for if this be well rammed, the roots of trees will not readily penetrate through it. Or, if the ground be thoroughly drained at a depth of 3½ to 4 feet, and the soil trenched, placing some inches of good drainage at the bottom, the iron oxide will be washed down, and carried off by the drainage, and the injurious action of what remains may be wholly or partly counteracted by repeated dressings of lime or chalk. By such means the subsoil may be greatly improved; but in all cases where it is not naturally good, or not completely sealed by concrete or other substances from the access of roots, the top-soil should be made so deep that there may be plenty of good nourishment for the plants without their roots having to seek deep down in the subsoil after that which is indifferent or bad.

3. Size.—The size of a garden should be in proportion to the capacity of the house and the number of its inhabitants, so as to afford an ample supply of fruit and vegetables. In estimating the proper size of a kitchen garden for a large establishment it has to be borne in mind that the whole of the working department is usually included within its precincts, and it is therefore necessary to provide room for glass structures of various descriptions, offices, stores, yards, and other conveniences, as well as for residences for the head and under gardeners. The space required for these in well-organized gardens is generally about one-

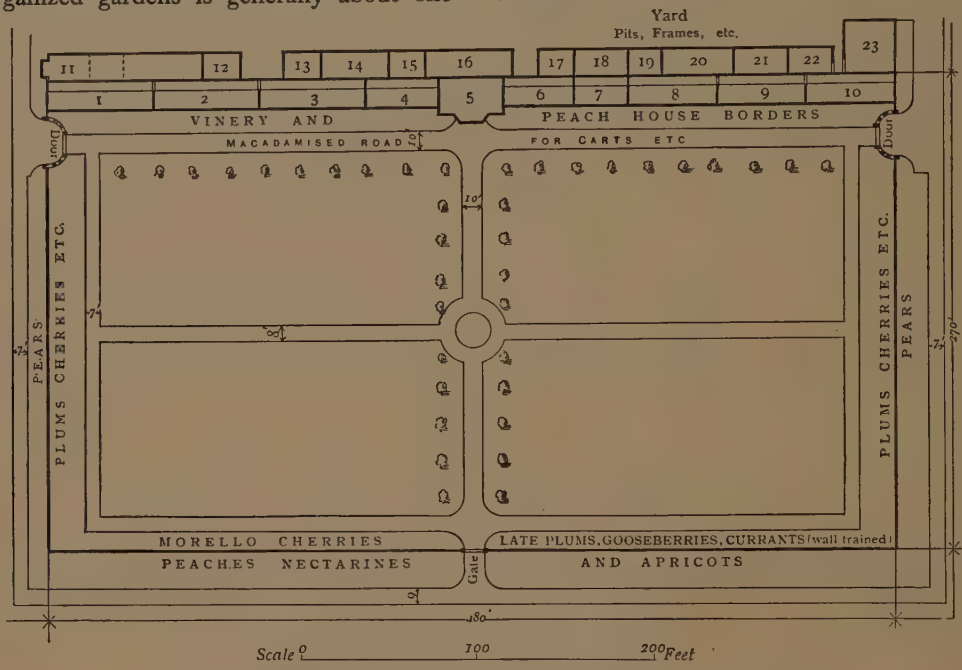

Fig. 2.—Plan for a large Kitchen Garden. 1-23, Houses, Sheds, Boiler-house, &c.

other of the sides. These circumstances will accordingly require to be taken into consideration when determining the extent of the area to be enclosed by walls. In the colder parts of the country, and especially where the situation is rather high and exposed to cold winds, the walled-in garden ought to be proportionately larger, shelter being, under these circumstances, required for many productions which in milder climates could be grown in the field or open garden. If there is an orchard to supply the hardier fruits, the garden may be much less than where fruits are not grown except on walls.

third of the whole enclosed area, which should be surrounded by a substantial vermin-proof fence. In regard to the area required to supply an establishment regularly throughout the year with abundance of first-rate fruit and vegetables, a general rule is to allow an acre of well-cultivated ground for every twelve grown-up persons to be supplied. To ensure a plentiful supply of all the better kinds of fruits and vegetables double this area may be allowed, as it is not so much in many cases what would suffice but what is required.

In some instances the slips outside the garden may be of considerable extent; or, on account of the boundaries, or of arrangements connected with pleasure-grounds, they may be more or less limited on one or

By a system of intensive cultivation and close cropping, a large quantity of vegetables may be grown in a comparatively small space. Vegetables, however, when so raised, are not generally so rich in flavour and fine in quality as when the different crops have plenty of room. Abundance of space is better than too little; for if, at any time, the whole should not be required for culinary vegetables, the spare ground may be used for growing any other crops that may be found most profitable. At all events, the ground need not be in any way wasted, however much more it may be than is absolutely necessary for a due supply of vegetables. Where ground is at command, the question of the extent of it to be enclosed depends greatly on the expenditure that can

be allowed for walls, a tolerably correct idea of the expense of which may be formed from the relative amounts here given for enclosing from 1 to 6 acres. Less than an acre can only be enclosed at great expense for walls in proportion to the extent of the ground. In general, a fruit and kitchen garden of 4 acres will be found sufficient to supply all the ordinary demands of a moderate-sized establishment.

Plans of kitchen gardens, showing positions of plant-houses, sheds, &c., are shown in figs. 2 and 3.

4. Form.—The form of a garden is not of material consequence in the cultivation of vegetables, which, with the exception of such as may require a south border, will succeed as well in a piece of irregular ground as in one of any other shape. But when the area is not rectangular, there is additional trouble and loss of time in carrying out the working operations. As fruit and kitchen gardens are generally surrounded by walls, the form of the garden and length and

Progress of Solar Radiation from Morning to Evening.

Time.	In Sun.	In Shade.	Difference.
	Thermometer.		
9 A.M.	93°	68°	25°
9½ ,,	103	69	34
10 ,,	111	70½	40½
10½ ,,	119	71	48
11 ,,	124	71½	52½
11½ ,,	125	72½	52½
12 M.	129	73	56
12½ P.M.	132	74	58
1 ,,	141	74½	66½
1½ ,,	140	75	65
2 ,,	143	75½	67½
2½ ,,	138	76	62
3 ,,	138	76½	61½
3½ ,,	132	77	55
4 ,,	124	76	48
4½ ,,	123	77	46
5 ,,	112	76	36
5½ ,,	106	75	31
6 ,,	100	73	27
Means	124¾	73½	51¼

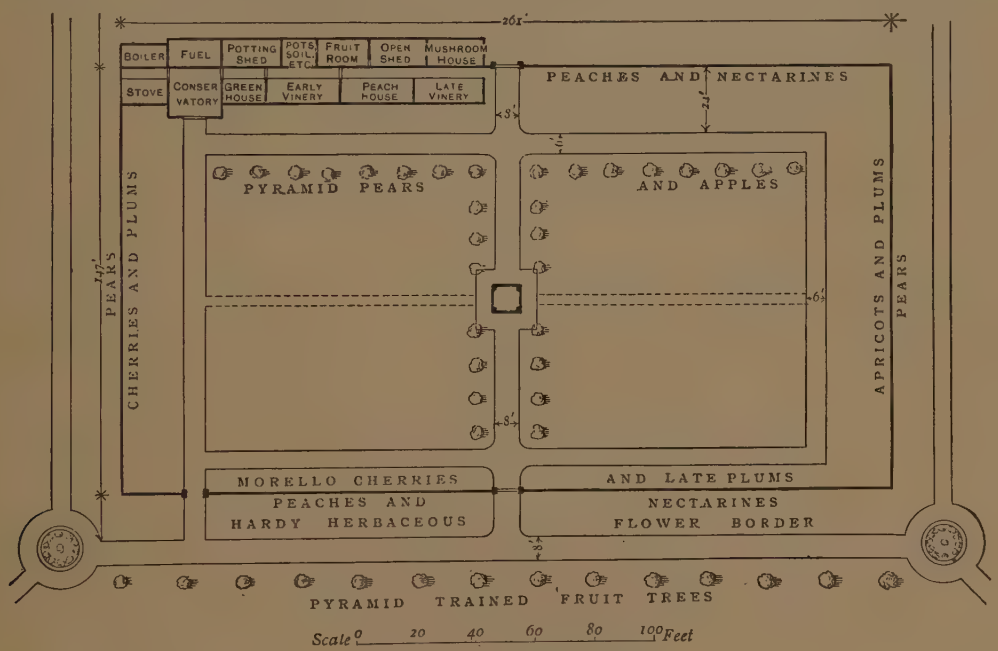

Fig. 3.—Plan for a small Kitchen Garden.

aspect of walls become important considerations. Much depends upon the surface the wall presents to the action of the rays of the sun during the period of the day when they are most powerful, that period being between one and two o'clock in the afternoon.

It will be observed from the following table that the highest temperature in the shade in June occurs between three and half-past four p.m.; but the power of the sun's rays was greatest between one and two p.m. Although the observations were only taken for one day, yet it was well selected for the purpose by one who was an authority on the subject.

The mean results of five series of experiments, conducted with every possible precaution, are contained in the following

table, showing the power of the sun's radiation from half-past nine a.m. to half-past six p.m. in the month of June :—

Progress of Solar Radiation from Morning to Evening, in June, upon an average of five experiments.

Time.	Force of Sun's Rays.
9½ A.M.	32°
10½ ,,	46
11½ ,,	55
12½ P.M.	63
1½ ,,	65
2½ ,,	63
3½ ,,	58
4½ ,,	49
5½ ,,	35
6½ ,,	29

Here it will be observed that the force of the sun's rays at half-past nine a.m. is on the average 32°, and that it increases between one and two p.m. to its maximum, 65°, or to rather more than the double of what it was at half-past nine a.m. It will also be seen that it increases rapidly between the hours half-past nine, half-past ten, half-past eleven, and half-past twelve ; and then during the next two hours the force is nearly uniform.

Moreover, the average force of the sun's rays in the three hours before twelve noon is, according to these observations, about 44° ; and in the three hours after twelve it is 62°. From this it is evident that a wall with a west aspect must be much warmer than one with an east aspect. The sun shines in a clear day as long on the one as on the other but not with equal intensity. For three hours before noon the sun shines on the east aspect at the same mean angle as it does on the west aspect for three hours after noon ; but during the latter period the rays have, according to the above observations, about 40 per cent greater intensity. The wall with the west aspect must therefore become much more heated than the one with the east aspect. After half-past three p.m. the power of the sun's rays begins to decline considerably, but as some compensation for this they impinge more directly on a west wall.

The southern aspect, being the most important, requires to be taken first into consideration. It may, according to circumstances, face either directly south ; or it may be inclined to the south-east, so as to face the sun about eleven a.m. ; or it may incline to the south-west, to face the sun about one p.m. In parts of the kingdom where the summer heat is sufficient to ripen Peaches and Nectarines on a wall facing the sun at eleven a.m., that aspect should be chosen, as in that case the adjoining walls can proceed at right angles and afford two good western aspects, on which the sun may commence to shine as early as eleven a.m., so that Apricots, Plums, Cherries, and Pears could be ripened to perfection upon it. But if the heat against an aspect thus inclined an hour to the east of the meridian is not sufficiently intense to ripen Peaches satisfactorily, the aspect must face the sun at noon ; and where the climate is still colder, it will be advisable to turn the aspect to face the sun at one p.m. The walls should, if possible, be at right angles to each other.

With regard to the aspects of the other walls, it would not be desirable that each should receive an equal amount of sun-heat in the course of the day ; for if this were the case, the consequence would probably be that although many of the finer varieties of Pears, &c., could be grown on both sides of the wall, yet none of the fruit would ripen to perfection. The eastern aspect must be planted with such things as are most suitable, chiefly summer or early autumn fruits ; for, owing to the ripening period of these being nearly that at which the hottest weather occurs, an indifferent aspect will ripen them tolerably well. Next, therefore, to the southern aspect, one that will be as little as possible inferior to it demands attention.

Where the southern wall faces the sun at eleven a.m., the western aspect, if at right angles to it, will have the sun, as already observed, from eleven in the forenoon, and would then be inclined to the south of west as much as will ensure the ripening of the fruits required to be produced against that wall. Where the wall on the north side runs from east to west, and of course faces directly south, the walls joining it will run north and south, but then the west aspect will have an hour less sun than in the preceding case, and consequently some things that would require that hour of additional sun could not be properly grown against it, and they would need to be planted against the south wall, which, therefore, would have to be extended to afford space for them.

Where the southern wall must face the sun at one p.m., and the walls joining it proceed at right angles from it, their western aspects will be shaded till one p.m., and rendered so much inferior as to be unfit for the ripening of such fruits as require an aspect little inferior to that of a south wall. This can only be obviated by giving the walls on the eastern and western sides such a direction as to present western aspects that will receive the sun's rays as early as

eleven a.m., although, by so doing, these walls will not join the others at right angles. The garden will then assume the form of a rhombus (fig. 4), or that of a rhomboid (fig. 5). These shapes are somewhat inconvenient for economically working the ground, and in dividing it into sections for the various crops; but the latter will grow equally well, whilst a considerable advantage is secured in regard to the ripening of fruits. The opposite sides of these figures being parallel, all the borders, beds, and quarters in the garden can also have parallel sides; and this being the case, although their ends do not square off, yet they are more easily worked than if the ground were wider at one end than the other, which must be the case where the opposite walls are not parallel.

From the foregoing statements it appears that the walls of a fruit and vegetable garden should have the following directions, according to the climate of the locality :—

1. In the warmer parts of Britain, the walls on the north and south sides should face the sun at eleven a.m., and the walls on the east and west should run parallel to each other, and at right angles with the north and south walls.

2. Where the climate is not quite so good the north and south walls may face direct south, with the east and west walls at right angles, and consequently running in the direction of the meridian. If the south

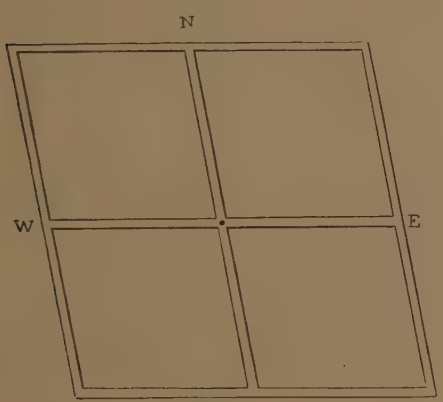

Fig. 4.

aspect of the walls, however, is of limited extent, the east and west walls may with great advantage run in the direction of the sun at eleven a.m., as in fig. 4.

3. In places where the hottest aspect is necessary to ripen Peaches and Nectarines, the wall on the northern side may be made to face the sun at one p.m.; and the walls on the eastern and western sides should then run in the direction of a point in the horizon above which the sun is perpendicular at eleven a.m., as in fig. 5.

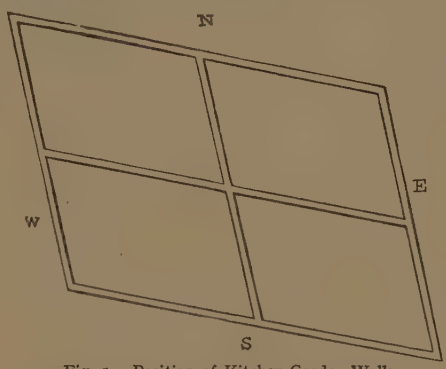

Fig. 5.—Position of Kitchen Garden Walls.

Where the Peach succeeds well on open walls, their position may be as in No. 1 instance. Where rather colder, the aspects pointed out in No. 2 may be adopted; and in the northern parts of Britain, the direction of the walls as described in No. 3 would be most proper. Where the situation is too cold or northerly for the cultivation of Peaches and Nectarines on open walls, the southern aspect should be occupied with Apricots, Plums, Cherries, and Pears. It is not absolutely necessary that the southern aspect should face or be exactly at right angles to the sun's rays at the hours mentioned, nor that the eastern and western walls should follow the direction of the hour-lines. Nevertheless the hour-lines are a convenient guide, and they may be easily found with sufficient accuracy by a good watch, allowance being made for the equation of time.

Table of the Angles which the Hour-Lines form with the Meridian, or Twelve o'clock Line, for every half degree of Latitude, from 50° to 59°.

Latitude.	A.M. 11.	P.M. 1.	A.M. 10.	P.M. 2.	A.M. 9.	P.M. 3.	A.M. 8.	P.M. 4.	A.M. 7.	P.M. 5.
50° 00′	11° 38′		23° 51′		37° 27′		53° 0′		70° 43′	
50 30	11 41		24 1		37 40		53 11		70 51	
51 00	11 46		24 10		37 51		53 24		70 58	
51 30	11 51		24 19		38 4		53 36		71 6	
52 00	11 55		24 27		38 14		53 46		71 13	
52 30	12 00		24 36		38 25		53 58		71 20	
53 00	12 5		24 45		38 37		54 8		71 27	
53 30	12 9		24 54		38 48		54 19		71 34	
54 00	12 14		25 2		38 58		54 29		71 40	
54 30	12 18		25 10		39 8		54 39		71 47	
55 00	12 23		25 19		39 19		54 49		71 53	
55 30	12 28		25 27		39 29		54 59		71 59	
56 00	12 32		25 35		39 40		55 8		72 5	
56 30	12 36		25 45		39 50		55 18		72 12	
57 00	12 40		25 51		39 59		55 27		72 17	
57 30	12 44		25 58		40 9		55 37		72 22	
58 00	12 48		26 5		40 18		55 45		72 27	
58 30	12 52		26 13		40 27		55 54		72 33	
59 00	12 56		26 20		40 36		56 2		72 39	

For a place in latitude 52° 30′, it will be seen, by referring to the above table, that the eleven o'clock line forms an angle of 12° with the meridian, or twelve o'clock line; the one o'clock line forms the same angle, but, of course, on the opposite side. Those who are acquainted with practical geometry, or with the rules of trigonometry, will easily find the means of laying off with sufficient exactness the above or any other angle.

The space most eligible for a garden, as regards soil and other circumstances, may not admit of any of the forms we have recommended; nevertheless the best form should in all cases be approximated as much as possible. If length from north to south can be obtained, but not from east to west, then the requisite extent of south aspect may be secured by one or more walls running across the garden. In hot summers certain fruits will ripen on a direct east or west aspect; but they will only do so imperfectly in ordinary seasons. We should not, however, be guided by exceptions. It is much better to have one good aspect than two that are indifferent.

The form of the garden must now be considered with regard to the extent of wall, and the area enclosed thereby; for some forms require a much greater length to enclose a given area than others. Within any given extent of outline, the circle contains the greatest area; next to it regular polygons; these figures, however, are but little adopted in gardens, more especially in fruit and kitchen gardens. For such, rectilinear four-sided figures are the most convenient; and of all these, the square contains the greatest area in proportion to the extent of outline. This form is therefore the one to be adopted, when the object is to enclose by four sides as much ground as possible within the least extent of wall. The more any four-sided figure deviates from a square, either as regards the similarity of the angles or the equality of the sides, the less will be the area enclosed, compared with the length of the boundary. For example, if 2 acres be enclosed in the form of a square, the length of the boundary will be about 1180½ feet, and the length of each side about 295 feet. With the same length of sides, but thrown a little out of the square so as to form a rhombus, as in fig. 4, the area would be nearly 7½ rods short of 2 acres.

The total length of wall that would be required to enclose a square of 2 acres would not enclose so much by 20 rods if the figure was a parallelogram, of which the length is to the breadth as five to three. For 2 acres this form would require to be in length 381 feet, and in breadth 228½ feet; consequently the total length of enclosure would be 1219 feet. It may here be observed that the expense of enclosing a garden is greater, in proportion to the quantity of ground enclosed, for a small garden than for a large one. Thus the total length of enclosure for—

1 acre,	in the form of a square,	would be	835	feet.
2 acres,	"	"	1,180	"
3 "	"	"	1,446	"
4 "	"	"	1,670	"
5 "	"	"	1,866	"
6 "	"	"	2,045	"

From this it appears that whilst 4 acres require 1670 feet, one-fourth of the length of wall will not enclose one-fourth of the area; for 1 acre requires just half as much walling as 4 acres. Of course a large garden must require more to enclose it than a small one; but, at the same time, the larger the garden the less will be the expense per acre enclosed. Supposing the walls to be 12 feet above ground, with a foundation 3 feet deep, in all 15 feet from base to top, estimating the brickwork at £16 per rod, the expense of enclosing—

1 acre	would be	about	£736
2 acres	"	"	1,040
3 "	"	"	1,276
4 "	"	"	1,472
5 "	"	"	1,647
6 "	"	"	1,800

It will be seen that the enclosure of a single acre, according to the above estimate, would cost £736; but when 6 acres are enclosed together the amount is £1800, or at the rate of only £300 for each acre enclosed. It will be evident, from what has been stated, that where it is an object to enclose a certain area with the least extent of wall, the garden, presuming that it is to be four-sided, must be in the form of a square. If, on the contrary, the object is to have a large extent of wall in proportion to the area enclosed, then the garden must deviate accordingly from the square, and be made to assume the form of a rhombus, the sides being equal; of a rhomboid, an oblong figure with the ends oblique; or of a parallelogram.

The southern aspect is so advantageous for the ripening of fruit that it ought to be kept chiefly in view in forming a garden. In bad seasons other aspects may fail in bringing fruits to perfection, and in such seasons well-ripened fruit is more especially valuable, and the best chance of obtaining it is from a southern aspect. On that

account it is desirable that the garden should be of a form which affords a greater extent of wall with a south than any other aspect.

The form may therefore be that of a parallelogram, of which the length is as five to three. Fig. 6 is very nearly in this

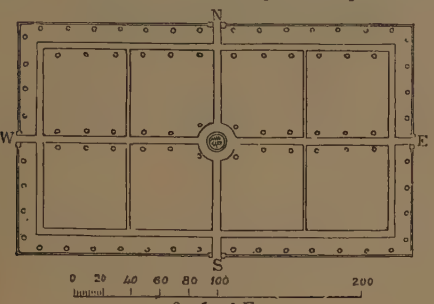

Fig. 6.

proportion, and represents a small garden, 272¼ feet from east to west, and 160 feet from north to south; consequently it contains exactly an acre. On referring to the figure, it will be observed that it admits of nearly double the number of trees on the south aspect, as compared with each of the others; and it allows a greater extent of espaliers to face the south, which is also important, as the fruit is more fully exposed to the sun throughout the hottest period of the day than it is in espaliers running north and south. Moreover, the figure admits of being divided into eight principal compartments, each of which forms nearly a square, after allowing for the space occupied by espaliers. Although it is not absolutely necessary to adopt exactly the above proportion of five in length to three in breadth, yet it will be found well suited for the convenient working of the ground, and for the ripening of fruits on walls and espaliers. The main area of the royal gardens at Frogmore is nearly in the above proportions, being 760 feet from east to west, and 440 feet from north to south.

Various other forms of gardens have been recommended, as well as different directions of the walls. Most authorities, however, agree that a square or parallelogram is the most convenient; but they differ in regard to the direction of the walls, and as to whether the length of the garden should be east and west, or north and south. Some recommend the walls on the eastern and western sides to face directly east, or between east and south-east, in order to have sun for a longer period during the early part of the day; we have already stated our reasons for differing from this. Others make the length of the garden run north and south, in order to have comparatively little extent of north aspect. As already explained, we prefer to have a considerable extent of aspect decidedly good rather than a small extent possessing this character, and the main part indifferent in that respect.

Taking all things into consideration, perhaps on the whole a parallelogram such as fig. 6 is the best form that can be generally recommended. It has, at least, the advantage of being rectangular and of a compact form for being economically worked; and whilst it presents a large proportion of walls with the very best aspect, it possesses very little with a decidedly bad aspect.

5. SHELTER.—In selecting the most desirable site for a garden, that affording the best natural shelter should be taken advantage of, where it can be done consistently with other necessary arrangements which must also be kept in view. But where the natural disposition of the ground affords little or no shelter, recourse must be had to artificial means for supplying it. Walls, it is true, afford a certain amount of shelter to the interior of a garden, and by absorbing heat from the sun, and radiating it again, a warmer atmosphere is generated within the garden and near the walls. It often happens in unsheltered gardens, especially in changeable spring weather, that, after the sun has heated the air in the interior during a clear and comparatively calm period of the day, and the motion of the sap has been stimulated in consequence, the sky becomes overcast and strong gusts of cold wind begin to blow and sweep through the garden, and quickly displace, by their mechanical force, the warmer and lighter air.

Walls afford good shelter when there is little wind, and that steady; but when there is much, it eddies round the inside of the walls, and produces far more injurious effects on the vegetation it meets on its course than it does on that which is entirely in the open ground, and not subjected to intermittent excitement. It is therefore of great importance that the progress which vegetation makes in a garden should be as much protected as possible from sudden checks; and this protection mainly consists in moderating the impact of cold winds.

Plantations should therefore be made, if possible, on the north-west, north, and north-east sides; the winds from these quarters being coldest. The shelter on the north and north-east of the garden should approach nearest to it, for these are the winds most to be dreaded. The nearer the

shelter, the more it will shade the garden, and the less light will the plants receive. But what can be grown on north and north-east aspects is of little importance compared with the subjects on the other and better aspects; so that the shelter of the latter is more to be considered than the partial loss of light to the former. Along the north side the screen may be as near as 60 feet, depending partly on the kind of trees employed; disposition of the shelter-belt of trees is shown in fig. 7.

The trees employed for shelter should be tall and quick-growing species. In these respects perhaps none excels the black Italian Poplar (*Populus monilifera*). It will form a good shelter in a few years, especially if the ground is well trenched and manured previous to planting, and afterwards kept clean, when it will increase about 4 feet

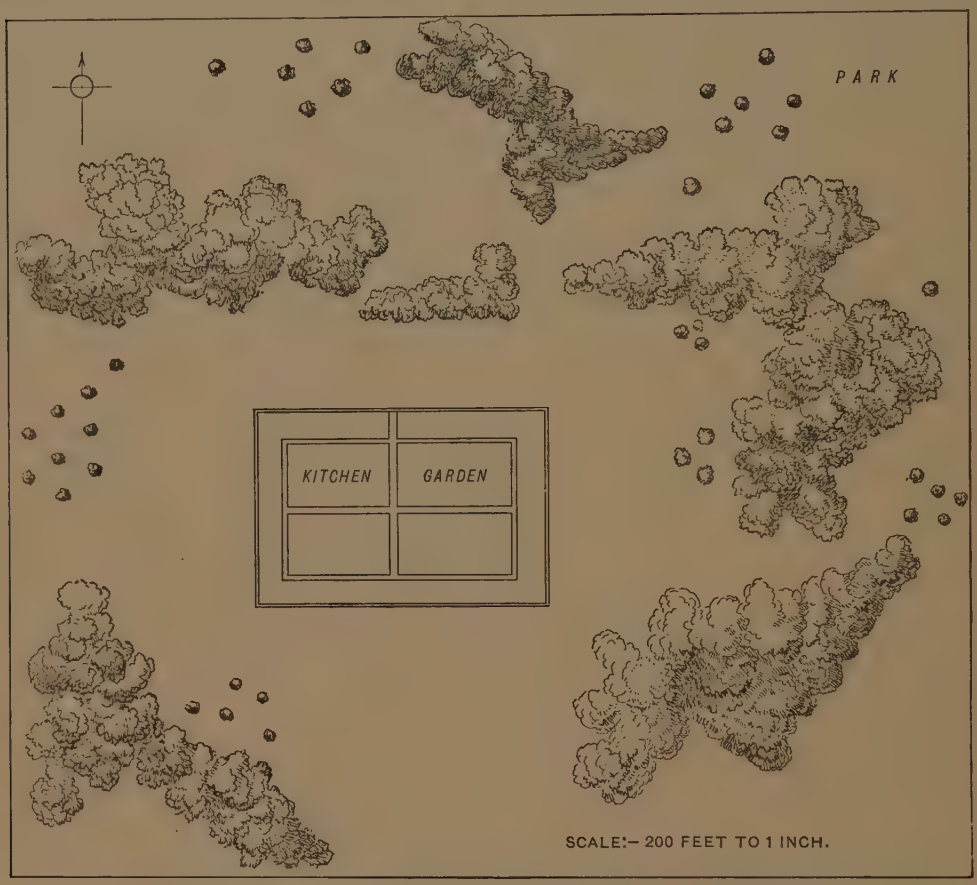

Fig. 7.—Site for Kitchen Garden in a flat and exposed situation, showing positions of plantations to shelter the garden from north, east, and south winds.

and at about the same distance off the screen may turn the north-east and north-west corners, but should then gradually open out to the south-east and south-west, with a free exposure to the south. After turning the north-west and north-east angles, the latter of which should be specially guarded, the shelter, instead of being a continuous belt, may consist of clumps at intervals, having a general direction to the south-east and to the south-west, with other clumps farther off, and opposite the intervals.

A plan of a kitchen garden indicating the annually till it reaches a height of 60 feet or more. The Larch and Sycamore are also quick-growing trees, and the same may be said of the Lime (*Tilia europaea*). The latter may be pruned and trained so as to form a close screen, or tall hedge, from the ground upwards. The Elm and Beech ultimately become lofty, but their growth is slower. Where the soil is suitable, the Norway Spruce (*Picea excelsa*), the Scots Fir (*Pinus sylvestris*), the black Austrian Pine (*Pinus austriaca*), and the Corsican Pine (*Pinus Laricio*) answer the purpose

well, and form excellent shelter-belts. In maritime districts, and especially in the milder parts of Britain, *Pinus insignis* and *Cupressus macrocarpa* grow fast, and make first-rate shelter; and the hardier *Thuia gigantea* and *Cupressus Lawsoniana* are very useful and effectual shelter trees.

The belt should be not less than 20 yards wide, and should be planted so that the quickest-growing trees are on the inner half, and the sturdier and more branching species on the outer edge, where they are most exposed to the wind. The Poplar, for instance, mixed with Spruce, or the giant Arborvitae, should be planted next the garden, and some slower-growing trees, such as Elm, Beech, Sycamore, Scots Fir, Austrian Pine, or Lawson's Cypress, according to the nature of the soil, will form the outer half of the belt. By its rapid growth the Poplar quickly forms a shelter; and if its appearance is not liked, the trees may be cut down when the other kinds are high enough to afford protection.

If some outposts in the form of kidney-shaped clumps of trees were established, the force of the wind would be considerably broken before it reached the belt. The clumps would be most effective if arranged with their convex side outwards in two series, and they may be at the distance of 200 or 300 yards. The clear distance between the clumps in each series should be about equal to their length, and the intervals so formed should be covered by the clumps in the second rank or series. In passing through between the outer clumps the velocity of one portion of the wind will tend to neutralize the force of the air sweeping round the end of the adjacent clump. If their forces should coalesce to a considerable extent, and the wind proceed in a direct course after squeezing through between the exterior clumps, it will impinge upon the clumps placed inside, opposite the intervals, and afterwards, with a broken-up and greatly diminished force, it will have to encounter the regular belt, which would effectually neutralize its force, and thus protect the garden from the evil effects of a biting cold blast.

As a means of preventing the wind from sweeping along the external surfaces of the walls of a garden, diagonally projecting walls, or high hedges, at each corner of the garden have been recommended, and are met with occasionally. For reasons which can be easily understood, such walls are not effective in preventing the winds sweeping the face of the garden walls. Instead of a diagonally projecting wall at each corner, it would be better to extend the wall on the north side of the garden beyond the eastern and western walls as far as the breadth of the respective borders, or even to the outside of the slip. By this means, also, an additional length of wall with a southern aspect will be secured. If the wall cannot be so extended, a high close hedge may be easily reared, which soon forms an excellent screen, and is much superior to a wall in all respects as a wind-break.

LEVELLING

After the site, size, and form of the fruit and kitchen garden have been decided upon, the next step is to determine the level of the ground, or the slope thereof, as the case may be. Walls cannot be built to any required height above the ground until the height of the surface of the soil is known. The ground may appear to be level, but it is necessary to determine whether it is really so or not; and if it is found to be irregular, the height of the plane which it will present when the irregularities of the surface shall have been levelled is necessary to be ascertained. If this be done with sufficient accuracy, a proper datum-line, or starting-point for the height of walls and other structures, the surface of the walks, the depth of the drains, &c., will have been obtained. Here it is evident that some knowledge of levelling is necessary; and as much expense has been too frequently incurred for want of such a knowledge, some plain directions on the subject may prove useful, and lead to better results, with less expense than is usually the case when the operation of levelling the ground is commenced in haphazard fashion, and the result left to chance.

Supposing a plumb-line to be suspended from *p* (fig. 8), it is evident that it would hang in the direction of the line *p c*, or towards the centre of the earth. Any line crossing this at right angles, as *d d*, is generally termed the horizontal line, the line of sight, or the apparent level.

It is scarcely to be supposed that a gardener can command a spirit-level so nicely adjusted that the line of sight will be perfectly horizontal when the bubble is in the middle of the tube. Its line of sight may direct to a point too high or too low, but by placing the instrument exactly in the

middle, as at *p* (fig. 8), any error arising from the above cause may be avoided. If the instrument at *p*, when the bubble is in the middle of the spirit-tube, has its sights

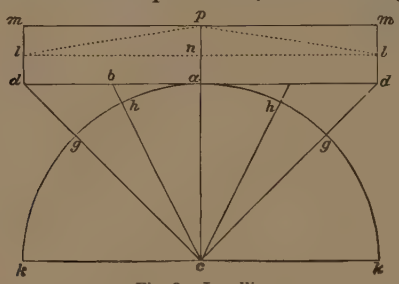

Fig. 8.—Levelling.

directed to *l*, say on the right, it is evident that that point is below the horizontal line; and when the instrument is turned round, it will point as much below the horizontal line at *l* on the left. These two points *l l* are both in the same horizontal line, although not in that of the instrument; for the distance being equal, the error is equal on both sides. It increases in proportion to the distance; therefore, if the instrument were not placed exactly in the middle, the two points *l l* would not be equidistant from *m m*, and consequently the straight line between the two former would not be parallel to the horizontal line of sight. In all cases, therefore, where the instrument is not of the most perfect description, and particularly well adjusted, it should be placed half-way between the staves, on which points in a horizontal line are to be marked. It may be observed, that on viewing from *l* to *l*, the error of the instrument will be seen to be *p n*; by measuring that distance from *l* to *m*, and then adjusting the sights of the instrument so that they will direct to *m* whilst the bubble is in the middle of the spirit-tube, a level may then be taken for a short distance without risk of any material error, even although the instrument should not be placed midway, which may not be possible in some cases.

Fig. 9.

To level a line, as, for example, that intended for the edging of a walk, prepare a lozenge-shaped piece of wood (fig. 9) about 6 inches broad; paint it white, with the exception of an inch all round the margin, which should be black; also, a strong black line across from angle to angle. A square hole cut on the upper side of the cross line admits of anything against which it is placed being marked exactly at the height of that line. If the length of the edging intended to be levelled do not exceed 600 feet, let a rod be placed at each end, and the instrument half-way between these. Let an assistant hold the lozenge-shaped mark against the rod at one extremity of the line, whilst the person at the instrument directs him to slide it up or down, till the line across its centre coincides with the line of sight from the instrument when the bubble is in the middle of the spirit-tube. Mark the rod at the height of the cross-line; and in the same way the rod at the other end of the walk. The two points so marked on the rods at each extremity are in the same horizontal line, like the points *m m*, or *l l*, in fig. 8. The instrument may now be removed, and a rod put in its place. By placing the cross-line of the lozenge-slide on one of the points to which the level was directed, and then viewing from the point at the other extremity, the rod placed in the middle can be marked at a point which will be in a horizontal line with the other two. There will then be three ascertained points on the same level; and by viewing between any two, as many more may be marked along the line as may be found necessary. Thus, on the rods placed between the two extremities, a series of points may be marked, all of which shall be in the same horizontal line. By measuring down a uniform distance from each of these points, the horizontal line which they marked may be transferred to the ground, or to the height to which the edging is to be worked. If this height be determined at any place, then it is only necessary to measure down to it from the level point originally marked on the rod, and to the same distance below each of the level points the whole edging should be formed.

If a border were to be made level across a piece of uneven ground, and so that neither more nor less soil should be employed than that which is found within its limits, the following mode of proceeding could be adopted: Place a rod at each end, and any number of intermediate rods at equal distances. Place the instrument near the middle of the length of the border, but not exactly in the direct line between the rods, in order that these may be seen without obstruction from end to end. Then mark points, in the manner before directed, at the same level on all the rods along the line. Now, as the ground was stated to be uneven, the level points will be at unequal heights

above the surface, and the question is, to what uniform distance below them the surface, when levelled, will reach without having soil to wheel away as superfluous, or any to bring in to make up deficiencies. We shall suppose the number of rods placed along the line to be ten. Measure down from the level points to the surface of the ground. Then, from these perpendiculars, find the mean depth of the space between the horizontal line and the surface of the ground. This is accurately found by the following method: To half the sum of the first and last perpendiculars add all the others, and divide the sum by their number, less 1; the quotient will be the mean depth of the space between the ground and horizontal line; and a line traced at that depth below the horizontal line will be the ground level to which, if the high parts are taken down, the soil from them will exactly fill the hollows. The following example shows the method of applying this simple rule. Suppose the distances from the ground to the level points marked on the ten rods are as in the accompanying table.

But cases may occur where the ground is so irregular that all the rods in the line cannot be seen from the same spot, and it may be required to find:

1. The difference of level between the extreme points.

	Ft.	Ins.
Rod 1	4	6
„ 2	3	6
„ 3	3	0
„ 4	2	6
„ 5	3	0
„ 6	4	6
„ 7	5	0
„ 8	4	3
„ 9	4	0
„ 10	2	6
Sum of first and last divided by 2	3	6
Sum of the other depths	29	9
Number of depths, less 1 = 9	33	3
)	3	8⅓

2. The height of a horizontal line, according to which the ground may be made perfectly level with its own soil.

3. The direction of a line, according to which the surface will form a uniform slope, with the least possible movement of soil.

1. To find the difference of level between the two extremities.—Place the rods A, B, C, &c. (fig. 10), at convenient distances, and so that the surface of the ground will be straight, or nearly so, between every two. The operation may be commenced at either end; here we shall proceed from A. Place the instrument half-way between A and B, mark the level points on these two rods,

Fig. 10.

and enter their heights from the ground in columns as under. Thus, after directing the instrument back to rod A, the line of sight is found to intersect that rod at 3 feet from the ground; write that height in the column headed back-sight. Then turning the sights of the instrument, and viewing forward to rod B, mark the level, and enter its height from the ground, 5 feet, in the column headed fore-sight. Move the instrument to station 2. Take there the back-sight level to B, and the fore-sight one to C, and enter the heights of these level points in the proper columns. Proceed thus till the levels are taken at all the stations: then sum up both columns; their difference is the difference of level. If the sum of the heights in the back-sight column be greater than that in the fore-sight one, the ground is rising; if the sum in the fore-sight column be the greater, the ground is falling, as is the case in the present instance.

Station.	Back-sight. Ft.	Ins.	Fore-sight. Ft.	Ins.	Distance of surface below horizontal line or datum, at	Ft.	Ins.
					A,	3	0
1	A, 3	0	B, 5	0	B,	5	0
2	B, 2	0	C, 5	6	C,	8	6
3	C, 3	6	D, 3	6	D,	8	6
4	D, 4	6	E, 3	0	E,	7	0
4	D, 4	6	E, 3	0	E,	7	0
5	E, 4	0	F, 4	6	F,	7	6
6	F, 2	6	G, 5	6	G,	10	6
	19	6	27	0			
			19	6			
Difference of level			7	6			

2. To find the height of a horizontal line *h l* (fig. 10), according to which the ground may be made level with its own soil.—Find the area of the perpendicular space between the surface of the ground and the horizontal line A G. Divide that area by the length of the horizontal line, and the quotient will be

the distance from the line A G to a parallel horizontal line *h l*, according to which the ground will be level; for there will be as much of the solid ground above it as there are vacant spaces below it; so that when the heights are taken down to that line and turned into the hollows, the whole will be level. Supposing the rods are placed at the distance of 50 feet from each other, the areas of the spaces between each rod from the ground to the horizontal line A G should be found, in order to ascertain the area of the whole space. This can be done as follows:—

Perpendiculars	A, 3 B, 5	B, 5.0 C, 8.5	C, 8.5 D, 8.5	D, 8.5 E, 7.0	E, 7.0 F, 7.5	F, 7.5 G, 10.5
	8	13.5	17.0	15.5	14.5	18.0
Base	50	50	50	50	50	50
	÷2)400	675	850	775	725	900
Areas ...	200	337.5	425	387.5	362.5	450

The total of these areas is 2162.5 square feet.

Now the object is, to find where a horizontal line can be drawn that will leave as much space or hollow below it as there will be of ground above it, or that will form the end of a parallelogram, the length of which is A G = 300 feet, and which shall contain an area equal to that of the whole space above ground, up to the line A G, or 2162.5 square feet. If it do the one it will certainly do the other; for a line that will include all the clear space above it must exactly leave that which is, or ought to be made, solid ground below it. We may therefore divide the area of the space by the length, and it will give the breadth of the parallelogram, or average perpendicular distance from the datum line to the surface of the ground. The total area of the irregular space is, as above found, 2162.5 square feet, which, divided by 300, the length, gives 7.208 feet, or about 7 feet 2½ inches, and this distance, measured down from the datum horizontal line A G, will determine the position of the required horizontal ground line *h l*.

In the above example the rods are at equal distances, and this being the case, the mean distance from the datum line to the ground could be found by merely adding to the half sum of the first and last perpendiculars all the others, and dividing this sum by the number of perpendiculars, less one; thus—

$$\frac{3+10.5}{2}+5+8.5+8.5+7+7.5=43.25,$$

which, divided by 6, the number of perpendiculars, less 1, gives 7.208, or 7 feet 2½ inches as before. But cases may occur where the rods, to give the correct area, must be placed at unequal distances, so as to be at the extremities of the different slopes, and then the mean perpendicular distance cannot be obtained by averaging the respective heights, but must be calculated by multiplying the sum of each pair of perpendiculars by the distance between them, and taking half the product for the area; or the sum of any pair of perpendiculars multiplied by half the distance, or half the sum of the perpendiculars by the whole distance between them, will, in either case, give the area of space included between the two perpendiculars. The rods, as before remarked, should be placed so that the surface of the ground will deviate little from a straight line between every two, or, in other words, at the highest and lowest parts of the surface.

Thus, however irregular the surface may be, levels can be taken on the rods, so that the distance from the ground to a horizontal datum line can be found at any point, and consequently the area of the whole space or section between that line and the ground can be ascertained. This area, divided by the whole base or distance between the rods placed at the extremities, will give the distance of the level ground line from the horizontal datum line. Here it may be observed that the centre of this ground level remains at the same height, although the ground may be laid to any slope. A border the length of the above line, 300 feet, may be perfectly level; and if three stakes, one at each end, and one exactly in the middle, are driven in till their tops are level with the ground, as where the lines intersect the rod D, the ground may be laid sloping, by lowering one end below the level, and raising the other as much above it, so that the top of the stake at one end shall then be, say, 1 foot above the ground, and the other 1 foot below it; still the top of the middle stake will be, as formerly, level with the surface, just as a plank supported at its middle between two fixed points may be placed horizontally, or more or less sloping, but the point at the centre will always retain the same position.

3. To find the direction of a line according to which the surface will form a regularly inclined plane or uniform shape, with the least possible movement of soil.—Instead of the ground being made perfectly level by the line *h l* (fig. 10), let it be laid sloping with its own soil by a line *i p*. Place a rod at each extremity, A G, and one exactly in the middle, at D. Find a line that will correspond with the horizontal level of the

ground between A and D, and another for the space between D and G. These lines may be found in a similar manner to that by which the line *h l* was found. Here the total area of the spaces between A and D is $200+337.5+425=962.5$ square feet. This, divided by the length of base between A and D, 150 feet, gives about 6 feet 5 inches to be measured down from the datum line A G for the horizontal level of the *upper half* of the ground. The areas of the spaces between D and G are 387.5, 362.5, 450 ; and their sum, 1200, divided by 150, gives 8, the number of feet to be measured down from the line A G for the horizontal level of the *lower half* of the ground. This is 1 foot 7 inches below the level of the other half. The mean between these levels gives the position of the horizontal line *h l* of the whole piece.

Now, whether the surface is reduced to a horizontal level, or whether it is laid sloping, the point in the middle of the horizontal ground line always retains the same position, the same distance from the datum line A G, and it is always at the surface of the ground, whether this be level or formed with a uniform slope. The mean level of both the upper and the lower half of the ground having been ascertained, also the general level of the ground *h l*, the central point at the intersection of the rod D must always be in the surface plane, whatever the inclination of this may be. On this point as a centre the line *h l* may have one end elevated to any required extent, whilst the other is equally depressed ; and still the ground will suffice to level itself to that slope.

But the question is how to determine the amount of slope so as to have the least possible quantity of soil to move. This can be done by a line drawn through the centre of the mean higher and lower levels, and such line will also pass through the centre of the general level. The same will be effected by setting up the difference of height between the higher and lower levels from *l* and down from *h*, marking the points *i p*, a straight line between which will give the direction of an inclined plane, requiring less moving of soil to form it than would be the case with any other ; and at the same time the ground will not have to be moved to so great a depth in certain places as if a horizontal plane were formed. These are important objects ; for, with reference to fig. 10, supposing the ground were to be reduced to a level, and that the portion of bank between A and B extended 200 feet, in that case 2670 cubic yards would have to be moved, partly into the adjoining hollow, and partly to the distance of upwards of 200 feet to the hollow between F and G. But by the slope ascertained to be best, the removal of as much as 487 cubic yards is saved, as well as the distant carriage. If the ground were required to be taken down to the level, the depth to be cut down from the surface to *l* would be 4 feet $2\frac{1}{4}$ inches. At that depth solid rock might be met with ; but by adopting a slope, the cutting would be reduced to 2 feet $7\frac{1}{4}$ inches.

Where the subsoil is as easily penetrated in one place as another, and where the surface has to be made of one uniform slope at the least expense, proceed in the following manner : Find the mean levels of the upper and lower halves, as *a b* and *c d* (fig. 11), and the difference of their heights,

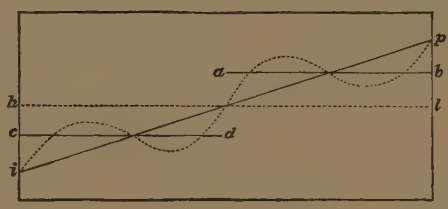

Fig. 11.—Levelling.

a d, say 4 feet. Half the difference marks the position of *h l*, indicating the mean level of the whole piece. Measure up 4 feet from *l* to *p*, and down from *h* to *i* ; the line *i p* will correspond with a slope requiring a less amount of labour than any other to reduce the undulating surface, represented by the dotted line, to a uniform inclined plane. It will be observed that the rising ground opposite *a* has only to be turned into the hollow at *b*, and the projection at *c* will suffice to make up the adjoining deficiencies near *d* ; and with these two simple operations the work is completed. If a steeper slope were to be adopted, it is evident that a quantity of soil would have to be moved uphill from near *i* towards *p*. If, on the contrary, the slope were to be made less than that represented in the figure, more than the minimum quantity of soil must be moved, although easier, of course, than in the other case, because downhill.

Hitherto the directions have been given for levelling a line, such as the edging of a walk, or a strip like a border, which, although sloping irregularly in the direction of its length, was supposed to be all along horizontal across. If those directions are well understood, there will be less difficulty in comprehending a more complicated part of the subject, which must now be entered into.

If the ground undulates with a general slope in one direction, say from north to south, and if it does so regularly across the whole area, the instructions already given will be sufficient; but it may also slope irregularly in other directions, so that neither the perfect level nor the general uniform slope of the least expensive formation can be so easily determined.

The substratum should be so regulated as to be a certain distance below the surface, namely, the estimated average thickness of the top-soil. The soil and subsoil may be worked accordingly, but both too high. By reducing the surface to the proper level, the depth of good soil, so far as the reduction goes, will be less than it ought to be, unless the substratum be also lowered. In order that such unsatisfactory and expensive labour may be saved, due care should be taken to ascertain the proper average level of the whole ground. In order to do this it is necessary to find at some convenient height a number of points in the same horizontal plane, so that from these the average depth of the space between that plane and the surface of the ground can be ascertained. Place a rod at each corner, as *a*, *b*, *c*, *d* (fig. 12), and, taking care to place the instrument half-way between the rods, in case of error from the line of sight not being exactly parallel with the axis of the spirit-tube, mark level points on the rods, say *a* and *b*, move the instrument to one of the adjacent sides, as between *b* and *d*, and mark similar points on each of them. Now, it will rarely happen that the marks on the rods taken from station *f* will correspond with those taken at station *g*. The difference, however, whether higher or lower, will be seen on the rod *b*. If it be, say, 10 inches lower, then mark 10 inches above the level point on the rod *d*, and this mark will correspond with the levels first taken between *a* and *b*. Proceed in the same manner with the levels between *d c* and *c a*, and thus four points, one at each corner of the ground, will be obtained in the same horizontal plane. If the ground is not very irregular, place rods at equal distances in line from end to end and across, so as to form the whole into squares, and by viewing from the level points at the corners, as from *a* to *b*, mark others on the rods placed intermediately along that line, and likewise on the rods on the opposite side, between *c* and *d*; and by viewing between each pair of opposite rods on these sides, the whole of the rods can be marked to the same level. Then, by the preceding rules, find the mean perpendicular of the space between the ground and the horizontal line on the side *a b*. Mark this down; and in a similar manner the mean of the next parallel line of stakes, and of all the other lines running in the same direction. Add the mean height of the line *a b* to that of *c d*, and to half the sum add the means of the heights of all the intermediate ones; divide the sum by the total number of rows of stakes, less 1, and the quotient will be the distance to be measured down from the level mark on each rod for the mean level of the ground.

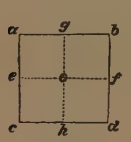

Fig. 12.

After due consideration of the foregoing directions and examples, with a little practice, any one may understand how to level sufficiently well for garden purposes. The best instrument for speed and accuracy in taking levels is a well-made Dumpy's Level, and every one who has a garden, or any other important piece of ground to level and lay out, ought to possess that handy and accurate instrument. Some may raise objection to its cost, but it soon repays itself in saving time and extra work; and if the first cost is considered too much for the job to bear, it can at least be hired for a trifling sum, which is generally saved in a single day's work.

Another useful instrument can always be found in an ordinary plummet level, as used by builders, and the levels can be carried on with it, from rod to rod, correctly enough, if proper care be taken, although not nearly so expeditiously nor so accurately as by Dumpy's Level. But it is better that some time should be occupied, even by this tedious process with a plummet level, than to commence operations at random, judging merely by the eye; for this, where the ground is very irregular, often proves very deceptive.

Workmen may be set to lower the parts that are too high, and to make up those that are too low; but in doing this they cannot know how much the one part should be taken down, or how much the other should be raised. They may, however, contrive to bring a height and its adjoining hollow to a tolerably fair level; by successive lowerings the height is at last reduced, and a uniform surface appears instead of the original height and hollow. After due pains have been taken to level this portion, the next height and hollow can be treated in a similar manner; but when this is done, in all probability the two portions thus levelled will not agree; means must therefore be employed to make them do so. The carefully levelled surface of the highest portion

must be broken up; third and fourth portions can then be brought to a level with the two first; still it may be questionable whether all may not have to be altered, in order to agree with the remaining portions of the ground. This is as likely as not, for it is all chance work.

One cannot set to work by chance with much confidence; he is always in danger of going too deep or too shallow, and of having to undo what he has done. He cannot tell, in fact, when or at what cost the work will be accomplished. It is very different when levels have been taken; the workman, in taking down a portion that is too high, knows by the marks on the adjoining rods how deep to go in lowering, and how high in making up, and he can then work freely, without hesitation or fear of going wrong. If ground be only worked roughly to the level marks in the first instance, still it will be found that a digging will render the whole surface perfectly satisfactory. Without knowing how to level, neither draining, trenching, nor other ground work can be well, and at the same time economically, performed.

Figs. 14 and 15 show how slopes or undulating ground may be treated so as to render them most suitable for the cultivation of fruit and vegetables.

DRAINING

We have treated at considerable length on the subject of levelling, because its importance, in many garden operations, renders a knowledge of it very desirable. We may now proceed with draining, an operation which should precede that of trenching and other ground work, but which ought not to be commenced until the level of the ground has been determined.

The beneficial effects of draining have been noticed under the improvement of soils, and matters more immediately connected with its practical application have now to be considered.

The necessity of draining is naturally the first question, for it would only be a waste of money to drain either a garden that is naturally too dry, or one that, on examination, is found to contain no superfluous moisture. Where the strata are of the character and arrangement shown in fig. 13

Fig. 13.

little or no artificial draining will be required. It is generally not difficult to decide at any time in the case of ground being too dry. Occasionally, however, the soil may be of a dry, open nature, and yet prove in certain seasons too wet below for the roots of fruit-trees. In this case the subsoil is usually of a very impervious nature, and lower than the high-water level of the channel which receives the drainage of the garden and its vicinity. The height to which the water rises in the channels after heavy rains can be ascertained either from actual observation or from the water-worn marks; and by taking the level from these to the garden, the height to which the temporary stagnant water will rise can be known. If the water only rises too high occasionally after heavy rains—if the rise is the exception and not the rule—the trees may thrive very well. But if it stands too high for a considerable part of the year, then it ought to be drained, if possible.

The site of a garden may be perfectly level, and at the same time naturally well drained. Where there is a good top-soil on a loamy subsoil, and this again on gravel conducting to a considerably lower channel, no artificial drainage will be required. Under such circumstances, if the mean temperature of the year is about 50°, and the annual amount of rain only 24 inches, fruit-trees will frequently suffer from dryness at the roots, and therefore ground so situated does not require drainage. Ground lying on a slope with an impervious subsoil, although free from springs, may yet be too wet in certain parts; for where the slope is irregular water may collect in the hollows. But when the subsoil is reduced to a regular slope, and these inequalities removed, the rain-water will not lodge in one place more than in another, and in all probability there will be no necessity for drainage. In short, where the subsoil has, either naturally or artificially, a regular slope, and where no water reaches it, beyond the rain which falls on the area, draining will not be required, except in climates where the average rainfall exceeds 30 inches in the year.

With a uniform, and, it may be, only a slight descent to a lower level, a moderately porous soil, even in a wet climate, may not be in want of artificial drainage; and, on the

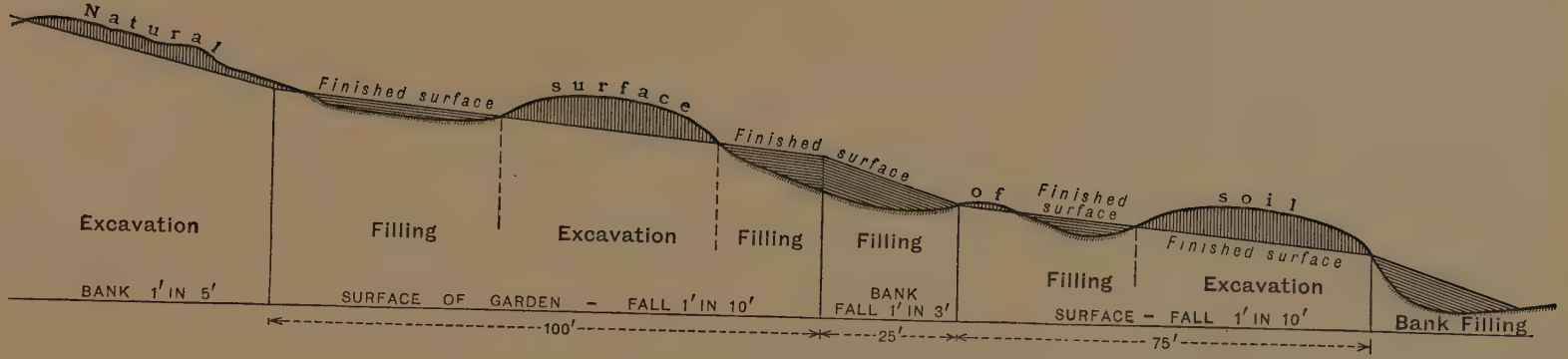

Fig. 14.—Method of dealing with an Undulating Slope.

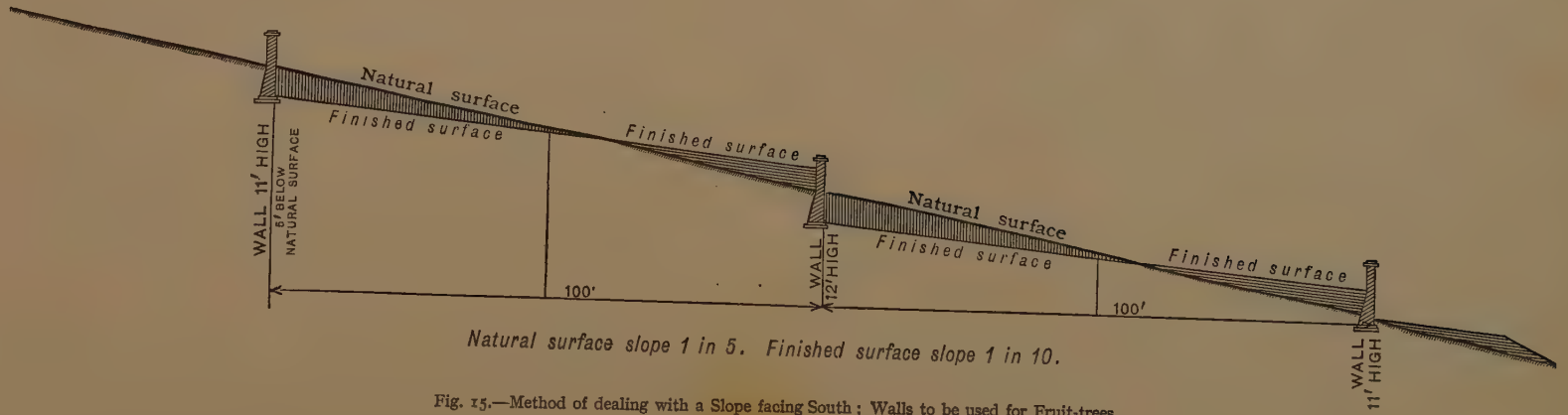

Fig. 15.—Method of dealing with a Slope facing South; Walls to be used for Fruit-trees.

other hand, ground may be so circumstanced as to be absolutely unfit for crops until it be drained, although the depth of the annual rainfall may be comparatively small. Whether, therefore, a soil requires draining or not depends much more upon its nature and other circumstances than upon the quantity of rain it receives.

The ground in this country being very irregular, the surplus water is conveyed to the ocean by streams and rivers. In some cases these natural channels may require deepening, but in general they can be looked upon as affording sufficient fall for the drainage of the adjoining ground.

Fig. 16 represents a tract of undulating

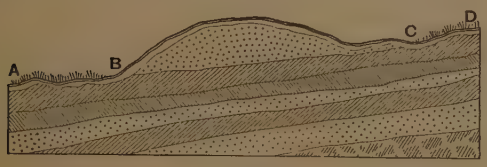

Fig. 16.

ground, a large portion of which rests on a porous subsoil, as from B to C, whilst from A to B and C to D are marshy, from the rain which falls on these portions not escaping; and it will be observed that the portion from A to B receives also the water which drains through the subsoil between B and C.

Occasionally the strata are disposed in the form of a basin as in fig. 17. The rain

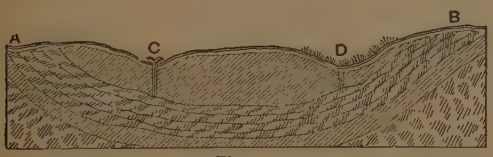

Fig. 17.

which falls at A and B percolates towards the centre, and the water may force its way through the thinner part of the mass of clay, as at D; by boring at C an artesian well would be obtained. Fig. 18 also

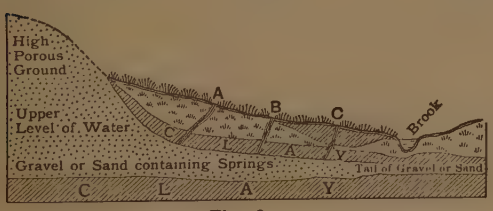

Fig. 18.

represents porous subsoil, in which the water is confined by layers of clay, except when it forces passages, or springs, from its pressure, through the upper layer, as at A, B, C.

In some clay soils a bed of sand or gravel, completely saturated with water, occurs at the depth of a few feet below the surface, with which it has corresponding undulations; but in places where its water is subjected to the greatest pressure, and the stratum of clay above it offers the least resistance, springs from it appear at the surface, or it saturates the soil so as to render it only fit for subaquatic vegetation. Fig. 19 exhibits

Fig. 19.

this arrangement of strata: where A represents the surface soil; B the impervious clayey subsoil; C the watery stratum of sandy clay or gravel; D the lower bed of clay resting upon the rocky strata; E and F, springs. Supposing the lowest portion of the stratum C, or that between E and F, to be 4 feet lower than the highest part of the curve on each side of it, then when the whole is completely saturated, the upward pressure between E and F will be equal to about 250 lbs. on the square foot.

Some rocky strata, impervious to water, are interrupted by fissures, as represented at AB (fig. 20), which are called *faults* by

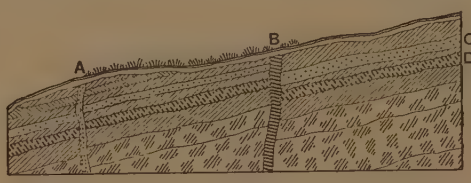

Fig. 20.

miners. Some of these fissures are occupied by substances which obstruct the passage of water, others with those of a porous nature. Let A represent a sandy stratum, B a clay one, and C and D porous strata charged with water; on reaching the fault at B, the water will collect, and rising upwards so as to form a spring at the surface it will render the soil between B and A too wet. The water, however, on reaching the sandy fault at A, will pass down through it to the porous strata, which, before the disruptions at A and B, had been continuations of the strata C, D.

It will be observed that the strata are sometimes as irregular as the surface, but this is not generally the case. On the contrary, they mostly form inclined planes, so that when we once get trace of a watery

stratum, and can ascertain the ratio of its slope, its depth from the surface at any point so far as it extends, and the place where it crops out to the surface, can be pretty well determined.

We must endeavour, in the first place, to find the direction of the greatest slope or inclination of the stratum. This may be done by digging down to it in three places, as at A, B, D (fig. 21), their position being such as to form three angles of a square. Then find the relative levels of watery strata at these three points. If D be the lowest, and A and B be on the same level, the slope of the stratum is direct from AB to CD. If B is the highest, and A and D equally lower, the greatest slope will be from B to C, crossing the diagonal at right angles in O. If B is the highest, A lower, and D the lowest, then the line of greatest slope will be through some point between O and D. To find this point, divide the line AD in proportion to the slopes of AB and BD. Let that of the former be 8 inches, and that of the latter 20 inches. Suppose the line AD is 226 feet 2 inches in length, and divided in the proportion of 8 to 20, it will give 64 feet 7 inches as the less, and 161 feet 7 inches as the greater portion. It is evident that the greatest fall will be nearer D than A; therefore the greater proportion set off from A to D, or the less from D to A, will mark the point through which the line of greatest slope, BF, intersects the line AD. Or, as the difference of level between B and D is to the distance between these points, so is the difference of level between A and B to the distance from B towards D, where the stratum will be at the same level as at A. Stretch a line from A to the point thus ascertained between B and D, and a line across it anywhere at right angles will indicate the direction of the greatest inclination of the stratum.

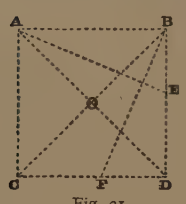

Fig. 21.

Suppose that from B to A there is a fall of 8 inches, and from B to D 20 inches, and that the side of the square from B to D is 160 feet; then as 20 inches : 8 inches : : 160 feet : 64 feet. At the distance, then, of 64 feet, from B to E, the stratum will have declined 8 inches, or as much as from B to A; consequently A and E will be on exactly the same level, and a line drawn between them will be at right angles to the line of greatest declivity. Accordingly, a line BF, stretched from B and across AE at right angles, will indicate the greatest inclination along this line.

The depth of the stratum below B should be ascertained at say 100, 200 feet or yards apart, noting the difference between each and that at B, in order to know the ratio of its slope per 100 feet or yards. If it slope, for instance, 6 inches in 100 feet, it is easy to find the amount per 1000 or any other number, so that at any point the depth below the starting-point can be calculated.

To ascertain the depth of the stratum at say 800 feet from B: Find the depth of the stratum at that distance, which, presuming that it slopes 6 inches in 100 feet, would be 4 feet; also, how much the surface at that distance is higher or lower than the surface at B; and let it be supposed that at the latter it is 3 feet above the stratum. If at the distance of 800 feet the surface is found to be 4 feet lower than at B, then it will have sloped just as much as the stratum, and of course will be, as at the origin of the investigation, 3 feet above it. If on the same level as at B, then the stratum, having in the interval sloped 4 feet, will be 7 feet from the surface; and if the latter is 2 feet higher than at B, it will be 9 feet from the stratum. If, on the contrary, the surface of the ground fall as much as 7 feet, it will meet the course of the stratum, which will then, as it is termed, *crop out*, as is the case with the porous stratum C (fig. 16), after passing under the elevated ground which intervenes between C and A.

Spring water, conveyed to a distance through such porous channels as those to which we have referred, cannot be too much guarded against, as it may render the latter not only wet, but too cold in summer for most kinds of garden plants. A slope may face the south, and be warmed by the sun, but this will be to little purpose if the roots are constantly chilled with cold spring water. In some places the temperature of well-drained land in the spring-time is probably not higher than that of spring water; but as the season advances, and the air temperature rises, so does that of the soil. But where affected by springs, the temperature of the soil does not rise in accordance with the increasing summer heat, and under such conditions vegetation cannot prosper.

Various kinds of drains are formed to suit different circumstances; they are either *open* or *covered*.

Open Drains.—The open drain, or ditch, was doubtless the original mode of draining off superfluous moisture, but it is now

generally superseded by covered drains. These economize the ground and they are usually the cheapest, open drains being apt to break down at the sides and fill up with weeds, so that much expense for frequent scouring is incurred. In their usual form, moreover, open drains or ditches in or near gardens are unsightly. If they are in any case admitted, they should be made in the form of ornamental water-courses and utilized for water- and bog-plants. A garden with such a system of drainage is shown in fig. 22.

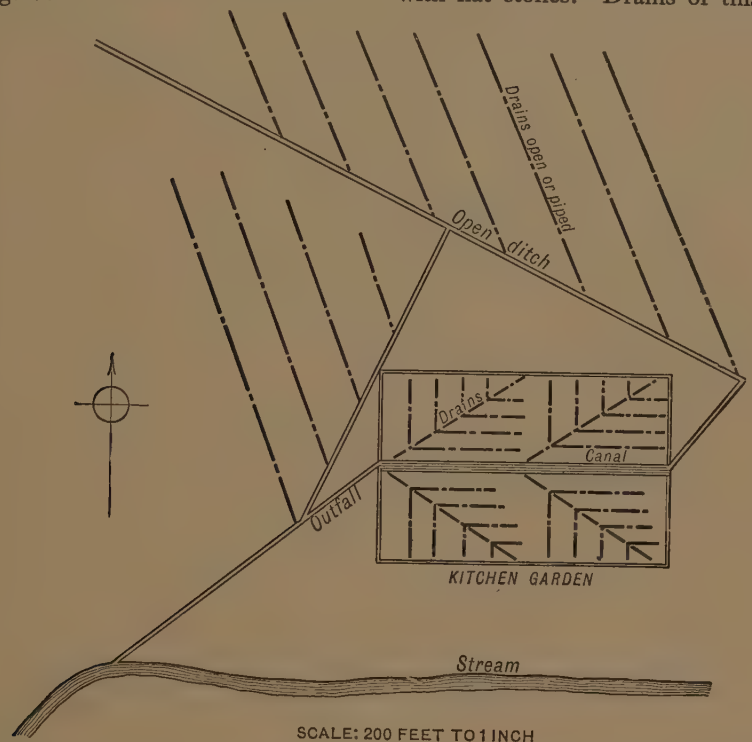

Fig. 22.—Site for Kitchen Garden where there is rising wet ground north of site. The plan for drainage shows how surface water is prevented from entering kitchen garden. The drains are conducted to centre of garden to form a wide open ditch or canal suitable for irrigation and the culture of Aquatic and Bog Plants. The kitchen garden is also drained into canal. Example of such a centre canal is at Crichel, Dorsetshire.

Covered Drains.—Some of these are formed by cutting out a narrow trench and making the bottom still more narrow, so that, when a thick turf is put in, a cavity for the water is left at the bottom; while others are filled up with fagots. It is needless, however, to notice these particularly, as stone- or tile-drains are so much better.

Where suitable stones are plentiful they should be used for the purpose of draining; and drain tiles or pipes can be obtained of any desirable shape, and at a reasonable rate, owing to the improved machinery employed in their manufacture. In some cases it is desirable to construct stone-drains, in order to get rid of stones taken out of the ground in trenching it to the proper depth. They can be made to act perfectly; but they may, like most kinds of drains, get stopped; and when this occurs they cannot be so easily taken up and relaid as tile- or pipe-drains, owing to the wedging of the materials, and their greater weight as compared with that of tiles. There are three kinds of stone-drains: the *box-drain*, the *couple-drain*, and the *small-stone* or *rubble drain*.

The *box-drain* (fig. 23) is chiefly formed with flat stones. Drains of this kind have to be carefully built by the hand, and are proportionately costly, but if well built and filled up with a foot of small stones or rubble on the top of the covers, they act effectively, and will last for ages. For permanent work they are worth their cost. They are made by selecting the largest and flattest stones for soles and covers. Great care must be taken to lay the upper face of the soles perfectly even, so that no part of a bottom stone rises half an inch above the general run, which can be ascertained by placing a straight-edge along their face. The bottom being thus made flat and fairly smooth to prevent obstruction and facilitate

the flow of water, the sides are built to the required height, packing the smaller stones neatly in between the larger ones to keep them firm and steady in their position. The covers are then laid on, taking care to place their flattest sides downwards, so that there may be no projections into the cavity. Small stones are then put over the covers to a depth of from 9 inches to a foot, and a layer of turf or other tough substance should be placed over the stones in order to prevent the soil from mixing with them. If 3 inches in depth of coal-ashes can be laid over the stones they will prevent worms working down and interfering with the drainage.

The *couple-drain* (fig. 24) is formed by

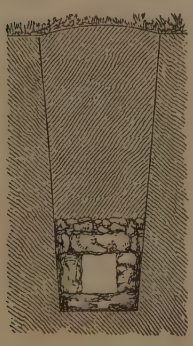

Fig. 23.

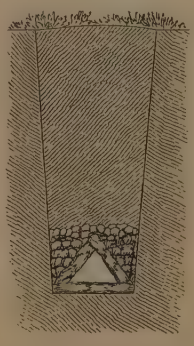

Fig. 24.

putting flat stones on the bottom for a sole, and upon this two other stones are placed, with their upper edges leaning against each other, so as to form a triangular cavity. The spaces between the sides of the drain and those of the cut trench may be filled up with smaller stones, and precautions similar to those employed in the preceding case are

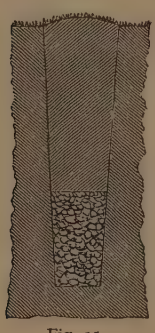

Fig. 25.

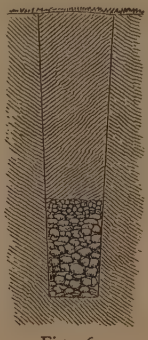

Fig. 26.

necessary to prevent the soil from closing up the drainage.

Figs. 25 and 26 represent sections of *small-stone* or *rubble drains*. They are 7 inches wide at bottom, and 9 inches wide at the top of the stones, the depth of the latter being 15 inches. These are the ordinary proportions, and make a good drain. The stones should pass through a 3-inch ring; and rounded land- or water-worn stones are better than broken rock or stones with flat sides and sharp angles. It is a good plan to put a layer of very small stones, several inches thick, over the others, as represented in fig. 26; for by so doing, the earth is prevented from passing down so readily among the lower portions of the drainage. Rubble-drains are not so well adapted for gardens as box-drains; for rich soil, such as that of gardens, usually abounds in earth-worms, by the workings of which the drains are apt to be compactly cemented. They may, however, be adopted with advantage in some cases; for example, an orchard may require a certain amount of drainage when the trees are first planted; but when they get large, it is frequently the case that they require all the moisture they can get; so that if the rubble-drains cease to act after the lapse of some years, the want of drainage will not be felt.

Tile-Drains.—There are several kinds of these. Fig. 27 represents the common

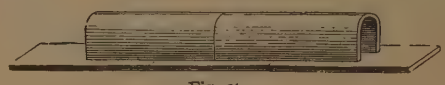

Fig. 27.

horse-shoe tile and its sole. The latter is sometimes dispensed with, but this is bad economy, because in most subsoils the bottom of the drain becomes soft, and allows the horse-shoe tiles to sink, diminishing the opening not only by the amount of sinking, but likewise rendering it liable to be completely choked up. If from any cause one tile should sink and those next to it should not, there will be an opening at the top through which soil will fall and in time choke the drain. This cannot take place where soles are used, especially if care be taken to place the horse-shoe tiles so as to break bond, that is, to rest on two adjoining soles, as they are represented in fig. 27. The sole tile should be carefully bedded, so that when pressed it may be quite flat. Some fibrous materials, or small stones if they are at hand, should be placed over the tiles before the earth is filled in. Fig. 28 represents a section of the finished drain.

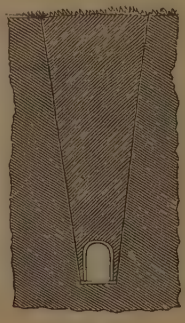

Fig. 28.

PIPE-DRAINS.—Experience has proved these to be the best and cheapest of all drains, and consequently pipes in some form or other are now almost exclusively in use for land drainage. They are made of different shapes, but chiefly cylindrical, as in fig. 29, for the draining of land. The

Fig. 29.

cylindrical form is found, on the whole, to be the best for the purpose. It can be laid with the greatest facility, and it retains its position better than the oval form, especially when the trench is properly cut out.

The width of the trenches should be just sufficient for a man to work in. In clay soils, when the trench is cut to within 9 inches or a foot of the intended depth, the bottoming tools should be employed to cut out a groove merely wide enough for the reception of the pipe, as in fig. 30. In loose gravelly or stony subsoils it may not be possible to cut a narrow groove so deep as 9 or more inches, but a depth equal to the

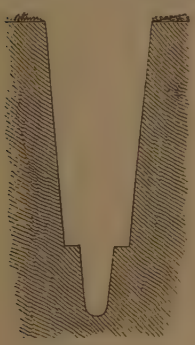

Fig. 30.

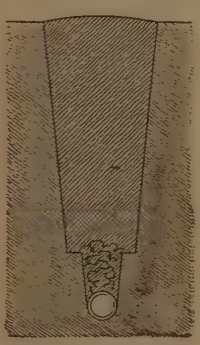

Fig. 31.

diameter of the pipe should at least be grooved out, so that the pipes may bed in the solid ground as accurately as possible. Fig. 31′ is a section of the finished pipe-drain, with 9 inches of small stones or rough ashes over the pipes, a method that should always be employed in draining garden ground.

Drain-pipes are sometimes furnished with *collars*, as represented in fig. 32. These

Fig. 32.

collars should be employed in draining gardens, as they not only tend to keep the pipes from shifting, and thus interrupting the continuous flow of the water, but they also prevent roots from insinuating themselves into the drains. The size of the pipes, or width of their bore, depends on the quantity of water which has to be carried off. With regard to the length of the drain, it is easily understood that if pipes of a certain capacity are necessary for a certain length of drain, and if that length be increased, the capacity of the pipes, or at least of those towards the lower end, must also be increased. In all cases, however, it is well to make sure of ample capacity for drawing off all superfluous water that may at any time collect.

Generally pipes of an inch bore in drains 24 feet asunder have proved to be more than adequate to discharge in forty-eight hours the superfluous water produced by the heaviest rains which occur in this country, provided that the pipes are all in good working order; but after a time it must be expected that obstacles to the free passage of water through the pipes will arise, in consequence of which many of them will have the bore partially, and some of them entirely, filled up. It is therefore advisable in gardens, where there is generally a difficulty in relaying the pipes in consequence of trees, to use tiles or pipes of ample capacity. 3-inch pipes are a fair average size, laid even and close, with 9 inches of rubble over them.

Figs. 33 to 37 represent various modes of forming main drains, one or other of which may be adopted according to circumstances. Fig. 33 is a combination of two horse-shoe tiles, with a tile-sole or slate between them. In many cases the lower end of a drain may so be formed, whilst the single tile (fig. 34) may be sufficient for more or less of the upper part. Fig. 35 is similar to fig. 33, but pipes are used instead of tiles, and when covered with 9 inches or more of small rubble are much the best form of small drains for a garden. Fig. 36 is well adapted for a main drain, as it allows a large quantity of water to pass. The same may be said of the arrangement seen in fig. 37, which affords a chance that if roots get into one or even two of the openings, still the third may be clear to act.

DEPTH OF DRAINS.—In many cases the depth of the drains is limited by the outlet. Where this allows of a sufficient fall, the top of the materials forming the drain should not be less than 3 feet below the surface, in order that they may not interfere with deep trenching, and that they may be further removed from the danger of getting choked by the roots of plants. Circum-

stances may render it desirable that the drains should be cut to a depth of 4 feet.

DISTANCE APART OF DRAINS.—The distance at which drains should be formed depends on various circumstances; chiefly upon the porosity of the soil or subsoil. In stiff tenacious soils the drains will require to be from 3 to 5 yards apart, but in lighter soils they will draw well at 6 to 8 yards asunder. If the depth of the drains is 4 feet, and they are laid the above distances apart, according to the tenacity or porosity of the soil, they will generally afford perfect drainage.

DIRECTION OF DRAINS.—In level ground the direction of the drain is, of course, determined by the outlet, or by a main drain communicating with some place of outfall. Where there are no springs, and only the superfluous water of a wet climate has to be drawn off, the drains should run in the direction of the slope of the ground, or slightly diagonal with it. If a watery stratum, causing springs, has to be intercepted by a deep drain, it ought to be cut more or less oblique to the direction of the stratum; for by crossing the slope of the stratum at right angles, the drain would probably be level; or, if cut so as to have a fall, part of its extent will be under the stratum.

In commencing the operation of cutting drains, the outlets of the main drain should be, if the declivity will permit, several inches above the surface level of the water in the channel of outfall. Drains on different sides of the same channel of outfall should not enter it exactly opposite each other, nor should any drain be led into the outfall, or into another drain, at right angles. Although the general direction of drains will often be at right angles to the channel into which their water is discharged, yet on approaching it they should form a gentle curve in the direction of the stream or main drain, so as to enter it at an acute angle. In this way the two streams will unite and clear away the mud that would otherwise accumulate at the mouth of the drain.

The small drains should have as much as 3 inches of a fall into the larger or main drains; and more than this, for the general outfall, would be desirable. It is a bad plan to terminate the minor drains in an open ditch, as they are apt to get choked. They should therefore be made to fall into main drains, from which the water will be discharged with greater force, and thus keep their outlets clear.

The main drains should be cut first. Then, as soon as the lateral drains are cut, they should be immediately laid, commencing the laying at the top of the drain, or the place farthest from the outfall, and terminating in the main drain, with which each junction should be carefully made. If the main consist of tile-pipes, there should be branched ones for the junctions; or if not, a hole should be cut out in the side of a main pipe, into which the terminating pipe of the lateral drain ought to be neatly fitted. When the first drain is laid into the main, the latter should be laid as far as the entrance of the next lateral drain, and thus the work should proceed till the whole is completed to the place of outfall.

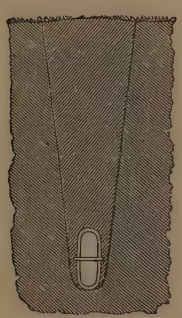

Fig. 33.

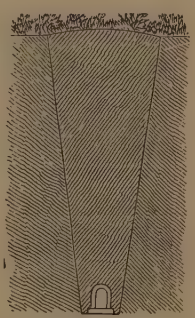

Fig. 34.

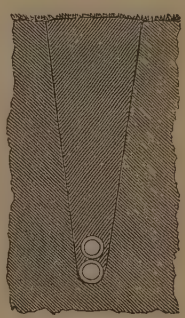

Fig. 35.

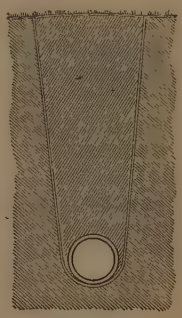

Fig. 36.

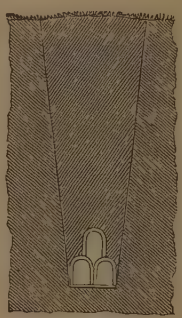

Fig. 37.

The beneficial effects of drainage greatly depend on a law of nature, which horticulturists should particularly bear in mind. It is a well-known natural law that water is at its greatest density, or heaviest, when its temperature is about 40° Fahrenheit. Consequently, in any body of water, that portion which is nearest 40° in temperature will sink to the bottom, while the warmer will rise and float over it. The heaviest water always occupies the lowest position, and will maintain it to the exclusion of the warmer and lighter water, unless disturbed by force. The main art and use of drainage is therefore to withdraw this cold and heavy portion, so that the warm summer rains

may sink down and occupy the place of heavy stagnant water derived from cold winter rains or melted snow, which cools the soil and chills vegetation.

The reader should consult the chapter on TOOLS AND IMPLEMENTS for information as to the tools required in the work of drain-construction.

BORDERS FOR FRUIT-TREES

In some cases the soil of a kitchen garden is so good that the fruit-tree borders require nothing beyond trenching and manuring, in common with the rest of the ground. But frequently more than this is necessary. The soil may have to be removed, and a better substituted. Occasionally it may be found necessary to remove the subsoil also to a certain depth. From these considerations it will be seen that the formation of the borders should precede the trenching of the rest of the ground.

WIDTH OF FRUIT-TREE BORDERS.—As a general rule it has been stated that the width of the borders should be equal to the height of the walls; but this rule should not be implicitly followed in every case. The walls of the royal gardens at Frogmore are all 12 feet high, but some of the borders are 15 feet, others 18 feet wide, a greater width being allowed to borders for Pears than those for Peaches and Nectarines, because the roots of the former extend farther than those of the latter. The principal consideration is the extent of border necessary for affording the roots sufficient nourishment. This partly depends on the nature of the soil, subsoil, and the situation. If the soil is rich, it will contain more nourishment in less compass than where the soil is of a poorer nature. If the subsoil is bad, and the situation cold, then the borders should be made wide, so that the roots may be encouraged to extend outwards rather than downwards. As borders can be cropped, it may be urged that there can be no loss of produce by making them broader than the trees require. For the growth of certain vegetables borders are preferable; but there are others that require the ground to be trenched occasionally, and this cannot be done when the border is occupied with the roots of fruit-trees.

A fruit and kitchen garden of the extent of 1 acre, or less, may have the borders 12 feet wide. If the garden contain 2 acres, the borders may be 15 feet; and if more than 2 acres they may be 18 feet wide, which is the greatest width that any fruit-tree border need be formed under any circumstances

DEPTH OF FRUIT-TREE BORDERS.—There is much difference of opinion with respect to the depth of fruit-tree borders. The depth recommended may be said to range from 15 inches to 3 feet. Shallow borders are advocated on account of their maintaining the roots near the surface, and consequently more within the ameliorating influences of the sun and air.

The advantages of the air being able to reach the roots of fruit-trees through an open friable soil, in which the roots run at a comparatively shallow depth, say 9 to 15 inches, are now well known to every successful fruit-grower, these being the roots upon which the crop of fruit mainly, if not wholly, depends.

Presuming that the soil is a good loam, but the climate not first-rate, a depth of about 3 feet is sufficient; and in a climate still less favourable, the depth may be reduced to 2 feet; or, if the subsoil as well as the climate is cold, 18 inches in depth will be sufficient. As borders are usually formed with a slope from the wall to the edge of the walk, and as this slope is generally greater than that of the bottom of the border, it follows that the depth of soil will be greater at the wall than at the side of the border next the walk. The several depths above mentioned are to be understood as *mean depths*; thus, where the depth of soil is recommended to be 2 feet, that will be the depth about half-way between the wall and the side of the border next the walk.

The bottom of fruit-tree borders should have a regular slope from the wall towards the walk, where draining should be provided. The amount of the fall depends on the width of the border. In general, a fall of half an inch in a foot is quite sufficient. This amounts to 6 inches for a border 12 feet wide; and 9 inches for 18 feet wide.

The amount of slope to be calculated for the surface of the borders is more dependent on circumstances than that of the bottom. In localities where the climate is good, and where the average quantity of rain does not exceed 24 inches, the surface of the border may lie nearly level; for trees in such places require, against a south wall at least, all the rain that falls on the border, and frequently more On the other hand, where the climate is cold and wet, a good slope is

advantageous, not only for throwing off superabundant moisture, but also for obtaining the heat from the sun. In such a case the slope may be as much as 1 in 12, or an inch in every foot; so that a border 12 feet wide would be a foot higher at the wall than at the side next the walk; and if 18 feet wide, 18 inches higher. Under ordinary circumstances a slope of 1 in 18 is ample.

If the bottom of the border is lower than the adjoining subsoil, and the two are not separated by an effective drain, the water from the higher subsoil will naturally drain into the bottom of the border, and cause the soil to become sour. If the border is cut off from the rest of the ground by a proper drain, it will not so readily become water-logged. Let fig. 38 represent a drain, and *a* the level of the surface of the subsoil, below which saturation occasionally takes place. This being the case, the drain must be cut deep enough to draw off the water for at least a foot below the bottom of the soil of the border at *a*. The bottom of a fruit-tree border should not, if possible, be lower than the general level of the subsoil *a*, which would be the case if it were dug out down to *c*, and even at *b* it is liable to be damp; it should therefore be above the line *a b*, as at *d*. The height of the bottom *d* above *a b* should not be less than 3 inches, and it might with greater advantage be a foot were it not for diminishing by so much the height of the wall. This involves the additional expense of four courses of bricks; but if that could be afforded, it would be compensated by the advantages arising from the roots of the trees being perfectly secure from an excess of moisture, and both foliage and fruit would be more exposed to air and light. In low damp situations these advantages are of great importance. If this plan is followed, the surface of the border will be raised above the general level, unless the border have a less depth of soil than the rest of the garden. It then becomes a question whether the level of the walks should be made to correspond with the general level of the ground or with that of the border. This, however, will be considered when we come to the subject of walks.

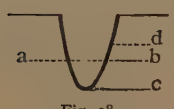

Fig. 38.

It is a question whether fruit-tree borders should be paved in the bottom, laid with concrete, or otherwise rendered impenetrable to the roots of trees. The soil of the most productive part of Kent is largely composed of rock brash, or *débris*, and is locally known as hassock or stone-shatter. The surface of this is a mixture of friable loam, largely intermixed with small pieces of light-coloured Kentish ragstone, and it is from 6 inches to 2 feet deep, resting on solid rock. This land produces hops and fruit in great abundance; likewise good crops of Turnips, Potatoes, seeds, corn, and excellent hay. Fruit-trees of all kinds flourish in it; even Peach and Pear trees grow with great luxuriance and health.

To what are such results to be attributed? Not to the climate, for localities enjoying a higher degree of temperature than the neighbourhood of Maidstone do not produce such fruit. They are due to the soil being naturally in that state best suited for healthy growth. In such a soil fruit-trees grow slowly, produce short-jointed wood, and mature their tissues perfectly as growth proceeds. Here, then, we have a naturally hard rock-bottom producing a healthy and fruitful vegetation.

At Trentham, Staffordshire, on a clayey subsoil, to prevent the injurious effects of the subsoil and situation, the fruit-tree borders were concreted with satisfactory results. We may therefore conclude that paving or concreting the bottom of fruit-tree borders is to be recommended in all damp situations. It is of special advantage where the subsoil contains substances injurious to vegetation. In such a case if the expense can be afforded it should always be carried out. Fig. 39 shows the wall, the construction of paved border, and the path in section.

Where the subsoil is good and not too moist, paving may be dispensed with. Its advantages depend upon the peculiarities of the soil, situation, and climate, concerning which the gardener must be guided by circumstances.

Concrete, or grout as builders term it, is a mixture of lime, gravel, and sand. It is much used for the foundations of walls and houses, and is likewise suitable for fruit-tree borders. The lime should be fresh and newly slacked, and the stones or gravel should pass through a sieve of an inch-and-a-half mesh. Where gravel is scarce, small broken stones, bricks, or cinders will do equally well. Four parts of clean river or washed gravel, one part of clean sharp sand, and one part of fresh hot lime, well mixed, and laid evenly down on the floor of the border to a depth of 4 to 6 inches, make a first-rate concrete bottom for fruit-tree borders. A more durable concrete is formed by adding to the lime one-fourth

part of Portland cement, and a layer of this 4 inches thick will serve as well as one of 6 inches containing no cement.

A concrete thus formed will be durable, and impervious to roots ; but if gravel cannot conveniently be had, a mortar formed of one part lime to three or four of sand will resist the roots of trees, if laid on a bottom of a uniform solidity to a depth of about 3 inches. This may be found cheaper than concreting.

In proceeding to lay down the concrete, care should be taken to prepare for it an even floor of uniform solidity. The breadth of the border, if not more than 18 feet wide, should be marked off into two divisions. An edging-board should be used, and care must be taken that the earth is removed perfectly clean at the joint, else it will cause a fissure through which roots may penetrate to the bad substratum.

Instead of concreting the border lengthwise, it may be done in cross sections, provided time is allowed for each to set before being covered with the soil of another. If properly made, this floor will be impervious to the roots of trees, but it will not be much warmer than the natural subsoil on which it rests. If this be undrained, and cold from the presence of spring water, that cold will be communicated to the concrete

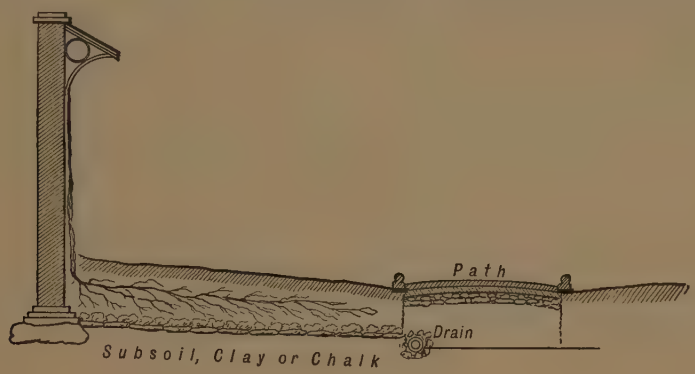

Fig. 39.

The soil of the one next the wall should be cleared out to the proper depth, the bottom made level and rammed equally all over. The prepared concrete should then be dropped into the hole and placed firmly and regularly all over the bottom and gauged to the proper depth with a straight-edge, making it smooth by beating it evenly with the back of a spade or shovel. This should be done before the concrete has had time to set, for after it does so it ought not to be disturbed. After it has set, which will be in a few days if the weather is fine, the soil of the other division of the border should be cleared out by turning it on to the concreted portion and proceeding as before.

or other substance with which such water comes in contact ; but drain off the latter and more warmth will be the result, the temperature of the air in a drained substratum rising in summer nearly in a corresponding degree with that of the atmosphere, so that both the roots and the branches of the trees are nearly in the same condition as regards temperature.

Whatever mode be adopted, in all cases where the borders do not naturally possess a good bottom, the expense of providing one will be amply repaid by superior crops. The border may be made of the best materials at great expense, but this would be of little avail if the soil were laid on a bad substratum.

SOIL FOR FRUIT-TREE BORDERS

The best soil for fruit-tree borders is a good loam. For Pears and Apples it may be inclining to clayey loam ; but for stone-fruits, such as Plums, Cherries, Peaches, Nectarines, and Apricots, a loam inclining to the sandy is preferable. Under particular circumstances of climate and locality, various compositions have been employed with success. Where the soil is naturally a good fresh loam, trenching will be nearly all that the border will require. If, however, first-rate borders are to be formed and fresh materials introduced, the best is a turfy loam from an old pasture.

In some places banks of loam to a considerable depth occur, and this becomes

friable by exposure to the weather; this, when mixed with good fibrous loam, varying from one-fourth to one-half the bulk, according as the fibrous loam is more or less plentiful, may be safely used. No fresh manure should be put into a newly-made border, as it is liable to cause too luxuriant growth. Where the loam is of a stiff tenacious character sufficient fine mortar rubble, charcoal, or sharp sand should be added to render it porous.

In many cases, borders cannot be made entirely of fresh turfy soil on account of the expense. Attempts should, however, be made to improve the natural soil as much as possible with the means at command. If the ground is poor and sandy, manure alone will not produce the permanent improvement in the soil which the trees require. A compost of well-rotted farmyard manure, mixed with equal portions of turf or pure loam, is much preferable; and that this compost may be where it will prove most useful, it should be placed about half-way between the top and bottom. Where good marl can be obtained, it forms an excellent addition to a poor sandy soil; and a dressing of stiff calcareous clay is generally very beneficial in its results on sandy soils. The dressing of marl or clay may be from 2 to 4 or more inches thick, according to the supply and the needs of the soil. If the soil is naturally a heavy clay, unsuitable for the healthy and fertile growth of fruit-trees, it should be burned and ameliorated by such means as have been already pointed out in treating of soils.

In situations where the climate is not sufficiently warm to ripen the wood which would be produced by trees in borders formed in the manner directed, great advantages have resulted from mingling stones with the soil of the border. The stones may be broken rock or roundish water-worn or land stones; or the *débris* of old buildings may be used, the old plaster and lime-rubbish being a valuable addition to the mixture, from which, however, all old and decaying bits of wood ought to be carefully removed, as they are liable to produce fungi that are detrimental to the roots of trees. The stones generally should be broken up to the size of half a brick, although a few larger pieces scattered through the mass will do no harm.

A layer 8 inches thick of stones or brick-rubbish might be trenched into the soil, and thoroughly incorporated with it, to great advantage, especially in a wet climate, and on close and stiff soils. A mixed soil of this kind—loam, or clay, stones, and rubbish from old buildings—closely approaches in its mechanical texture and chemical composition the famous fruit-producing soil in the Maidstone district of the "Garden of England," the county of Kent. In such a soil the trees produce a mass of fibrous roots, which form a network on the stones and other hard substances, and are productive of a sturdy and fertile growth, resulting in abundant crops of fine fruit of the best quality.

The good effects of covering fruit-tree borders with a layer of stones may not at all times be apparent, but some first-rate growers of fruit put great faith in that method of keeping the roots near the surface. Under good management, considerable success is attained by this method on some soils, especially on those resting on a cold, stiff subsoil. Instead of running down into such an ungenial subsoil, the roots push upwards and spread over the soil beneath the stones, where stimulating liquids and beneficial gases from the atmosphere easily reach them, and induce a healthy and fertile growth. On stiff soils this method of covering the borders with stones and applying liquid manure of any approved kind, and which easily finds its way through between the stones to the roots, is superior to top-dressing or mulching with farmyard manure. On light soils, however, farmyard manure is preferable.

The kind of hard materials that may be advantageously mixed with the soil is not unimportant; for the roots of fruit-trees take to some in preference to others, and especially to such calcareous substances as old mortar and plaster. As a general rule, it is admitted that sudden changes of temperature are prejudicial to animal and vegetable health, and hence the roots of plants prefer contact with those substances which maintain the most uniform temperature. Old plaster, for example, will best answer the purpose if broken into bits that will pass through a 4-inch ring. Lime compounds of all kinds are slow conductors, therefore pieces of old mortar and chalk lumps may be freely used. Brickbats—especially from bricks made near London, which consist of a considerable quantity of carbonaceous matter—are very suitable for mixing with the soil of a border requiring what are termed *warm* materials.

We have now endeavoured to point out the principles, and to detail the modes of making fruit-tree borders according to different circumstances of soil, subsoil, and climate. Where all these are favourable,

proper trenching and levelling are only necessary. If the subsoil is bad, or cold and wet, its contact with the roots should be cut off by an impervious and somewhat elevated floor of concrete; if the soil is indifferent, it should be ameliorated as much as possible; if bad, it should be entirely removed, and a better soil substituted. Where the climate is at fault, it is advisable to use rather light soil, mixed with stones and other hard substances. There are, however, without doubt, very many cases where borders could not, on account of expense, be made so effectually as we have recommended. In these cases the borders should not be deeply trenched, if by so doing the principal roots would be encouraged to occupy a position unfavourable to the health of the trees. It will be better to depend on keeping the roots near the surface, and there feeding them by means of an annual top-dressing of dung or some concentrated manure and the most suitable kinds of soil that can be obtained.

PREPARATION OF THE GROUND

The formation of the borders having been completed, the preparation of the rest of the ground may be proceeded with. Where the surface is level, or of the proper slope, and the soil naturally good and of the sufficient depth, merely trenching it over in the usual way renders it fit for laying out and cropping. Where the ground is, on the contrary, irregular, and the undulations of the subsoil, not corresponding with those of the surface, render the soil of unequal depth—or where soil has to be wheeled or carted from one part of the ground to another, or introduced from the outside—the operations become complicated, and various preliminary considerations are necessary in order that the work may be commenced at the proper place, carried on with regularity, and in the best and most economical way.

It is presumed that the level of the ground has been previously determined, as recommended in the section on levelling, and that the depth of soil has been ascertained. By digging down to the subsoil at a number of points, adding together the depths, and dividing by their number, the mean depth of the soil will be found. At the same time, the depth at which the subsoil lies below the proposed surface level, at the different points, should be marked on a plan. By these means we come to the knowledge of the present position of the subsoil, and also that which it should be made to occupy.

If the surface is to be made level, and if the soil is to be of uniform depth, then the substratum must also be made level, or preferably with a slight declivity towards drainage. If the surface is intended to have a regular slope, the substratum ought to have a corresponding one. In either case it is evident that attention should be first directed to the levelling of the bottom. When a trench is turned out to the depth of all the good soil, its bottom most probably will be very irregular; portions of it may be too high or too low, which should be rectified before the soil of the next trench is moved. The work should be commenced in the lowest part of the ground, taking care however, to leave roadways for carting materials if necessary.

In trenching level ground the ordinary trench, about 3 feet wide, will be found most convenient; dividing the ground into convenient portions, as represented by *a b c d*, fig. 40. It is better to divide the

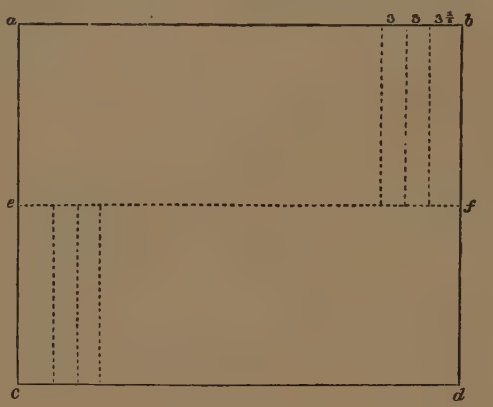

Fig. 40.

ground into two sections, as shown by line *e f*. Then dig a trench from *b* to *f*, and lay the soil on the adjacent half, from *f* to *d*. When the operation reaches *a e*, the open trench is to be filled by the soil taken from *e* to *c*, the last trench at *f d* being filled by the soil placed there from the first trench *b f*. Where the ground is very uneven, and where the bottom has to be raised or lowered to a considerable extent, the width of the trenches may be 4, 5, or even 6 feet.

Hitherto we have chiefly directed attention to bringing the substratum to the proper level, and when this is done, the good soil

will require to be made of uniform depth by removing portions from where it is deeper than the average, to where it is too shallow. If additional soil and manure are required they may be introduced as the trenching proceeds. The latter should be placed half-way between the top and bottom, and a good layer of well-rotted dung should also be dug or ridged in near the surface of the ground, after the latter has been levelled, especially if much fresh earth has been turned up.

WALKS

In planning walks for the fruit and kitchen garden, utility ought to be the leading principle; whilst regularity should be kept in view as much as possible.

With regard to their number and direction, the necessity of one all round, so as to leave a border of greater or less breadth between it and the walls, is universally admitted; and two intersecting each other in the centre of the garden are found convenient. This arrangement is very generally adopted. Besides these principal walks, two or more subordinate ones, as represented in fig. 6, may be necessary; but the number and direction depend upon the extent and form of the ground.

Where walls for fruit-trees form the fence the distance of the walls from the outside walks will be according to the width of border provided for the trees. Supposing the walls are 12 feet high, and that the enclosed area consists of 2 acres or more, the distance of the walks from the walls may be 18 feet. If the wall on the south side is lower than elsewhere, as is frequently the case, the walk next it may be 12 feet distant. Where the area is between 1 and 2 acres, the walk in front of the south-aspect wall may be still 18 feet distant, and that by the north-aspect wall 12 feet; but the others on the east and west sides 15 feet. In smaller gardens the distance of the walk from the walls may be only 12 feet, in order that the ground to be laid out in quarters may not be too much reduced; whilst in very small gardens the walks may run within 3 or 4 feet of the walls, except that facing south, the border of which should be as wide again, this, from its south exposure, being so useful for early crops.

The width of the walks should be in proportion to the extent and character of the garden. For small gardens the walks should not be less than 4 feet wide. In gardens of between 1 and 2 acres, the walks should not be less than 5 feet, whilst in those of larger extent they may be 6 feet; and to admit of manure, &c. being conveniently carted along the cross walks they may be 8 or 9 feet wide, with a circle, where they intersect, large enough to admit of a horse and cart turning round in it. These are fair average widths for walks in gardens of the various sizes, as they afford sufficient free space for working operations.

The width of walks having been determined, we have next to consider their height with reference to the general level of the ground. Generally the edges may be made a little lower, and the middle or crown a little higher than the soil level. The lines of the walks having been set out and marked by small stakes driven at each end of them, so that the tops of the stakes shall also mark the proposed height of the edging, the soil should be well trodden or otherwise made compact, then by means of boning or levelling rods, a number of points should be made on the same level as the tops of the stakes at each end. When the soil has been taken out to the proper depth, the line should be again stretched so as to mark exactly the line of edging, and Box, or some other suitable plant to form a live edging, may then be laid.

The excavation should be deep enough to hold a sufficient depth of materials to constitute a walk substantial enough for wheeling upon. The cross walks, where wide enough, and in fact all the walks in large gardens, should be firm enough for carting upon. The excavation for this should be at least 9 inches deep from the level of the edging, but where the heaviest traffic is wheeling, 6 inches will be sufficient. It is a question whether the bottom of the walk should be dug out level, convex, or concave. The best plan in dry climates, and on friable soils, is to give the bottom a curved form like that of the surface of the walks, in order that the water may fall to both sides, where the well-drained and trenched ground will always be in condition to receive it. Where it can be afforded, drains should be laid on either side of the walk with catch-pits at intervals, so that the water should not collect on the surface and spoil the walk.

Various materials may be used for the bottoming of walks, such as stones, flints,

brickbats, clinkers, lumps of hard lime-rubbish, burned clay—in short, any hard substance that contains nothing pernicious to vegetable life may be employed. Granite, broken to pass through a 3-inch ring, is perhaps of all others the most durable ; and broken whinstone, or trap rock, is nearly as substantial. Nine inches thick of such firm material, with 2 inches of rather coarse, and one of fine binding gravel at top, form an excellent walk. Indeed 6 inches of broken granite and 3 inches of gravel will make a good substantial walk.

If gravel is not obtainable, coarse sand may be used for the purpose, but it loosens exceedingly after frost, so as to render walks made with it unfit either for walking or wheeling upon for a considerable time. Decomposed sandstone answers tolerably well. A mixture of coal-tar and gravel was once somewhat popular for surfacing walks, but at best it is very unsightly, and if not laid on very thick, is liable to break when wheeled upon in cold weather. In hot weather the tar melts, and smells, and it is, moreover, dangerous to the roots of trees. Its use is therefore not to be recommended. On the whole, nothing is more suitable or has a more pleasing appearance than a well-made gravel walk. Cement, concrete, and asphalt are frequently recommended, but they are out of harmony with the surroundings, and are costly.

An inexpensive walk may be made as follows. Let the place for the walk be taken out to the depth of 3 or 4 inches, well beaten and rolled, and raised in the middle, taking care to keep the bottom quite regular. A layer of brick rubble, or any other hard material that can be most readily obtained at the least expense, should be spread evenly over the bottom, and well rolled until the surface is almost as even as that of a finished walk. A coat of gravel should then be laid on, to the thickness of 2 or 3 inches, treading, raking, and rolling it before it gets dry. By rolling into the surface a thin coating of fine gravel every two years or so, the walk will become more and more solid. If there should occasionally be much wheeling upon it, planks could be used.

The centre of the walk should be a few inches higher than the sides according to its width—say 3 inches for a 6-feet walk, 6 inches for 12 feet, and 10 inches for 16 feet. The surface of the gravel is most easily made uniform when the exact height of the centre of the walk is first set out by means of the boning rod and pegs.

Edgings for Walks.—Amongst the various plants which have been proposed for edgings, clipped Box, which has been so long employed for the purpose, still unquestionably maintains its pre-eminence. In small gardens such dwarf and compact growing plants as London Pride, Sea Pink, Gentianella, Ivy, Thyme, Parsley, and Strawberries are sometimes employed ; but none of them approaches Box in neatness of appearance and ease of keep. Live edgings are all more or less objectionable on account of their harbouring vermin. A Box edging, however, can be kept within such small limits that it affords but little shelter for anything hurtful to vegetation. In many gardens the walks are edged with tiles, bricks, stone, or wood, and when properly laid these are generally preferable to plants for the purpose, though they are of course more expensive. If tiles are used they should be fixed with cement or concrete.

From what has been stated, it is clear that the walks in a fruit and kitchen garden should run in straight lines ; that they should be of equal breadth throughout ; that they should be made so as to bear the greatest weight that may be conveyed over them in ordinary circumstances ; that their surface, from end to end, should be perfectly level or uniformly sloping ; that the elevation of the middle above the sides should be sufficiently great to ensure dryness, but not greater than will allow of comfort in walking ; and, lastly, that the margin between the walks and the soil should be clearly defined by means of a distinct edging.

In many kitchen gardens of the present day, especially where the garden is in close proximity to the house and pleasure-grounds, borders more or less central are provided for the cultivation of herbaceous perennials. They make the kitchen garden more interesting and attractive, and are useful for supplying cut flowers. A suitable edging for such borders is an irregular line of rockery stone arranged so that dwarf herbaceous and Alpine plants can be set between and about them. Where these borders are of sufficient width pyramid fruit-trees are planted to form the background.

KITCHEN GARDEN VEGETABLES

The present chapter deals with the food plants usually grown in the kitchen garden and popularly known as Vegetables and Herbs.

The uses of the plants, their cultural requirements, and, in some cases, their preparation for the table are given. The list of varieties is in most cases distinctly selective. It is scarcely worth while to attempt to describe each variety for purposes of identification, but any decidedly useful and distinctive characters are given. Nor is it considered worth while to give the synonyms, in some cases very numerous, of the varieties. The names here preferred are those that are in general use among English cultivators and seedsmen.

VEGETABLE CROPPING

It is well known that the same kind of crop cannot as a rule be successfully grown on the same ground for several consecutive years. Farmers know that if land be too frequently cropped with Clover it becomes what is termed Clover-sick, and fails to produce good Clover till after a rest of several years. So much is this the case that in some districts two rotations intervene before the ground is again sown with Clover.

Various theories have been formed as to the causes which render the rotation or alternation of crops necessary. Some plants contain a greater amount of certain mineral substances than others; for instance, some require potash or soda, some lime, others phosphoric acid, others silica, and so on. This being the case, it is evident that it would be beneficial to cause one crop requiring only a small quantity of any particular inorganic substance to succeed another requiring that substance in large amount. Such is the explanation of the beneficial results attendant on the rotation of crops, but in practice results at variance with its conclusions are sometimes obtained. Crops requiring a large amount of a certain mineral food are found to succeed if planted immediately after other crops that are known to require the same food in nearly equal quantities. Moreover, by merely restoring the inorganic matters abstracted from the soil by any crop, we do not fit it for the immediate production of other crops of the same kind.

For information on soil and its properties, tillage, &c., see chapter on Soils and Manures.

The necessity of a change of crops, whatever be the reason, being undoubted, it remains to point out what are the general rules which are found the best in practice. These are :—

1. Plants of the same natural order should not succeed each other.

2. Crops which occupy the ground for several years should be succeeded by others of short duration; thus, Asparagus or Strawberries may be followed by Cabbages or Lettuces.

3. Plants grown for their roots or bulbs should not be succeeded by others grown for the same purpose; neither should plants grown for their seeds follow each other.

The above rules apply to all systems of rotation, but it is impossible to recommend any particular course of cropping as the best, as this depends upon the quality of the soil, the manure at command, size of garden, and products required. The market-gardeners round London, who are justly considered to be our best vegetable growers, adopt no particular system of rotation. They manure highly, trench frequently, and plant any crop that is fit for planting out when the ground becomes vacant. In doing so, however, they follow, as far as practicable, the rules just given.

Two modes of cropping are adopted in gardens. The first may be termed separate cropping, the second simultaneous cropping. In the former, the ground is only occupied by one crop at a time; in the latter, by several. For instance, summer Spinach

may be sown between the rows of Peas and Beans, Radishes along with Carrots, or Lettuces together with Onions, or planted between the rows of Celery, &c.

With regard to the comparative merits of these two modes of cropping there is much difference of opinion. The finest productions are undoubtedly obtained by the separate system; whilst a greater weight of produce of all sorts, but generally of inferior quality, is obtained by the combination mode. To carry out the latter properly, the soil must be rich and frequently manured; whilst by the other mode good vegetables may be grown without so much manure. On the whole, the separate mode of cultivation is best for large gardens; combination cropping for those of small dimensions; and in gardens of medium size both systems may, to a certain extent, be employed. Thus, succession crops of Spinach, Lettuce, Colewort, and Borecole may occupy the ground between other crops.

It is impossible to detail systems of cropping that would be applicable in all cases. Circumstances render the demand for any particular article exceedingly variable, so that no exact limit can be assigned to the quantity of ground necessary to be allotted to each. Again, the garden may be large enough to admit of several quarters being cropped with Potatoes; and in that case it would be proper to direct that Coleworts and Cabbages should be planted where the Potato crop has been cleared. But, should the garden be small, so as to render it advisable to grow only a few early Potatoes on some of the borders, other places must be found for the Cabbages.

Although directions cannot be given to meet all circumstances, yet it may be useful to point out such crops as may not inappropriately follow each other, either in the same season or in the one next ensuing. In most cases an ample choice will be found, so that, either as regards cropping the ground or producing successional supplies, no difficulty need be experienced. Thus:—

Beans may follow Borecole, Broccoli, Cabbages, Parsnips, Carrots, or Potatoes: between the rows may be planted Borecole or Brussels-sprouts. Beans may be succeeded by Celery, Leeks, Lettuce, Turnips, and any of the Cabbage tribe, especially when the ground in the previous year has not been cropped with any of these.

Beet may follow the Cabbage tribe, and any other crop except Spinach, Turnips, Parsnips, Carrots, Salsafy, and Scorzonera. Beet may be succeeded by Peas, Beans, Cabbages, Cauliflowers, Lettuce, or any other spring-sown crop, except Spinach, Turnips, Parsnips, and Carrots.

Borecole may follow Peas, Beans, Lettuce, and Potatoes, or be set between the rows of Beans and Potatoes. It may be succeeded in the following spring by Peas, Beans, Beet, Carrots, Parsnips, Onions, Potatoes, Celery, Kidney-beans, or any but the Cabbage tribe.

Broccoli may follow, in the same season, Peas, Beans, or Kidney-beans. Between the rows nothing. May be succeeded by any crop requiring to be sown or planted when it is cleared off, except the Cabbage tribe.

Brussels-sprouts. Same as *Borecole*.

Cabbages may follow or be followed by Peas, Beans, Kidney-beans, Potatoes, Lettuce, Onions, and any other crop not belonging to the same order as themselves. Between the rows Coleworts.

Carrots may follow or be followed by any but root crops, and Celery and Parsley. Between the rows nothing.

Cauliflowers. Same as *Cabbages*. Between the rows Lettuce, Spinach, Endive.

Celery may follow any crop which is cleared off the ground in time, as it is dependent for nourishment on the fresh manure added in the trenches. Between the rows Lettuce or Endive may be planted. May be succeeded by Peas, Beans, Kidney-beans, Onions, Potatoes, Turnips, or any of the Cabbage tribe.

Endive may follow Potatoes, Peas, Beans, the Cabbage tribe; but not Lettuce, Scorzonera, or other Compositae; and with these exceptions may be succeeded by any crop suitable for borders or other situations where Endive is grown.

Kidney-beans. The same as *Beans*.

Leeks may follow any crop but Onions, Garlic, Shallots, Rocambole, or Chives.

Lettuce may follow Peas, Beans, Potatoes, the Cabbage tribe, and any other crop, with the exception of Endive, Chicory, Salsafy, Scorzonera, Artichoke, Cardoon, and other Compositae.

Onions may follow the Cabbage tribe, Celery, Potatoes, Peas, Beans, Kidney-beans, and even Onions, where the ground has been highly enriched by suitable manure, and where the produce is obtained free from canker. May be succeeded, without any further preparation of the ground beyond surface hoeing and cleaning, by Cabbages or Coleworts.

Parsnips. The same as *Carrots*.

Peas. The same as *Beans*.

Potatoes may follow any crop. Between the rows Brussels-sprouts, Borecole, or Broccoli may be planted; or late Celery, if certain rows are left somewhat wider than usual to admit of a trench being dug between them. They may be succeeded by any crop requiring a loose, clean, well-worked soil.

Sea-kale may follow Potatoes, or any except Cruciferae. May be succeeded by Potatoes, Peas, Beans, and others not included in the above exceptions.

Shallots may follow Peas, Beans, Potatoes, Cabbages, and the like, also Lettuce, Endive, Spinach. May be succeeded by any crop except Onions.

Spinach may follow Peas, Beans, Kidney-beans, Cabbage, Cauliflower, Lettuce, or any other crop, Beet excepted. Winter Spinach may be succeeded by any spring crop.

Turnips. The same as *Carrots*.

It may happen that a crop may have to follow another of the same nature; such may be owing to limited space, or a back-

ward season may render certain crops too late for being gathered in proper time for allowing the ground to be occupied by the usual succession. When this is the case, the ground should certainly be trenched or dug two spits deep, manured, and given a good surface-dressing with burnt garden refuse, also lime if the soil is deficient in this.

Quantities of Seed required

A correct seed estimate can only be made from experience of the relative amount of each kind of vegetable required. The extent of ground to be cropped may be taken into consideration in connection with the greater or less demand for certain articles. In some families certain kinds of vegetables are in great demand, whilst others are scarcely asked for. The estimate must be framed accordingly. A few deficiencies may easily be made up in good time; whilst a slight excess is in most cases desirable, and even advantageous. Many kinds of seeds keep good for several years, and of these it is well to have a surplus; for if they prove true to their variety, a sowing can be made in the following season that can be depended on. The quantity of seeds required in general to crop an acre of garden may be estimated as follows :—

Peas,	8 qts.	Cress,	1 qt.
Beans,	3 qts.	Endive,	1½ oz.
Kidney-beans,	2 qts.	Leek,	1 oz.
Scarlet-runners,	1 qt.	Lettuce,	3 oz.
Borecole,	1 oz.	Mustard,	1 qt.
Brussels-sprouts,	1 oz.	Onion,	6 oz.
Broccoli,	2 oz.	Parsley,	2 oz.
Cabbage,	2 oz.	Parsnip,	4 oz.
Red-cabbage,	½ oz.	Radish,	1½ pt.
Savoy,	½ oz.	Spinach (summer),	1 qt.
Cauliflower,	1 oz.	„ (winter),	1 pt.
Beet,	2 oz.	Salsafy,	½ oz.
Carrot,	6 oz.	Scorzonera,	½ oz.
Celery,	½ oz.	Turnip,	4 oz.

VEGETABLES IN DETAIL

ALEXANDERS (*Smyrnium Olusatrum*).—A native of Britain, formerly cultivated for its leaf-stalks, which, having a pleasant aromatic flavour, were blanched and used instead of Celery and in flavouring soups. Is little used now.

ANGELICA (*Archangelica officinalis*, fig. 41).—A native of Britain. The tender stems, stalks, and midribs of the leaves are used in confectionery, candied with sugar. The seeds are used in flavouring. In some parts of the north of Europe the leaves are eaten either raw or cooked together with fish or flesh. The plant is raised from seed sown in August or in March, and frequently watered, and grows well in any good soil in a cool moist situation. Should be planted 2 feet apart each way. Will be fit for use in the following May or June. The stems should be cut down before flowering; the plants will then thrive for three years.

Fig. 41.—Angelica (*Archangelica officinalis*).

ANISEED (*Pimpinella Anisum*).—An annual, native of Egypt, cultivated in the Levant and in Spain for its seeds, which are employed in confectionery, in distillation, and for the manufacture of a well-known cordial. Is sometimes grown in this country for its leaves, which are used for garnishing and seasoning. It requires a light soil and warm situation, where it may be sown in April in drills 6 inches apart, and the young plants thinned to about 3 inches apart.

ARTICHOKE (*Cynara Scolymus*).—A hardy perennial, native of southern Europe. Cultivated for its flower-heads, of which the fleshy receptacle, commonly called the bottom, and the base of the involucral scales, are the parts used (fig. 42). Sometimes the central leaves of plants about to be destroyed are blanched, and used like Cardoons.

The Artichoke is by no means fastidious, but prefers a deep sandy loam and an open

situation. The ground should be trenched 3 feet deep and well manured with stable-dung. Seaweed is an excellent manure for it, and salt is beneficial when the soil is not clayey. Another method is that of dividing the plants either in November or the second week in April. The best varieties are less hardy than the common ones, and in many localities it is not safe to risk the entire stock in the open, but to pot or box some suckers annually in November and winter them in a cold frame for planting out in April on well-worked ground, 3 feet by 4 feet. Old stools should never be allowed to remain on the ground more than 3 years.

Suckers.—From six to twelve suckers are produced by each stool. In April, as soon as the leaves are 8 or 10 inches in length, the stools are uncovered and the suckers slipped

Fig. 42.—Globe Artichokes ready for planting.

off with a heel, two or three of the finest being left on the parent plant. The suckers are then planted 4 inches deep, 8 or 9 inches apart, in clumps of three, placed 2 feet from each other, in rows 4 feet asunder. Water should be given till the plants begin to shoot. Where the ground is stiff, it is a good plan to dig a trench 18 inches deep, and fill it with a mixture of dung and mould, and in spring to plant on this. In the autumn of the year of planting some heads fit for use will be produced.

Seeds.—Globe Artichokes are easily raised from seeds, and strong plants can be had in one season. They cannot be depended upon to come true to name.

The seeds are sown either under glass or in the open. Sown in a pan in February or March, and placed in heat to hasten germination, the seedlings quickly appear, and when fit should be placed singly in 4-inch pots in loamy soil and kept growing in heat till well established, when they should be hardened off in a frame before planting them out in April or May, 18 inches apart, in rows 3 feet asunder. Seeds sown in April in the open ground in shallow drills 3 feet apart, thinning the seedlings until eventually they are left 18 inches apart, if kept free of weeds by stirring the soil about them with a hoe, will produce good plants by August.

When Artichoke heads are required for pickling, they should be gathered when about 2 inches in diameter; if for the bottoms, when they are nearly full-grown and before the opening of the scales. As soon as the crop from each of the flower-stems is gathered they should be cut down; and all dead leaves should be removed at the same time. Any heads remaining in November may be preserved for a long time, by cutting them off with the whole of the stalk attached, planting the latter in moist sand in a shed or cellar, secure from frost, and cutting off, every three or four days, a small portion from the stalk.

Towards the end of November, or before frost sets in, the extremities of the longest leaves must be cut off; the ground should then be forked over, but in doing this care must be taken not to injure the roots. After the ground has been forked, a good thickness of dry litter, bracken, or other protecting materials, should be packed closely round the plants, but not over their heads, previously placing round them a cone of finely-sifted cinder ashes about 1 foot in thickness, to prevent injury from slugs and to protect from severe frosts. Before severe weather sets in the plants should be well covered overhead, but the covering must be removed whenever the weather is mild, and again replaced at the approach of frost. Towards the end of March, or as soon as all danger of severe frost is over, the protecting materials may be entirely removed; but if any of the plants have been partially blanched, as is not unfrequently the case, they should be gradually exposed to the light. Afterwards, when the leaves are 8 or 10 inches in length, the stools should be uncovered; and all the suckers, with the exception of two or three of the most vigorous, having been removed, but so as not to injure the roots of these, the earth should be again replaced round the plants. This having been done, the ground may be forked over, a good soaking of liquid manure given, and, with the exception of keeping

it free of weeds, nothing further is required till the plants come into flower in June or July, when the ground should be thoroughly mulched with long stable litter.

Artichokes may be forwarded somewhat by means of a framework and a covering of mats, and the season be prolonged in the autumn with similar aids. Every year, as the crop is gathered, the flower-stems should be cut down, as previously indicated; and the same treatment with respect to protection from frost, removing suckers, forking the ground, &c., should be pursued. After the second year, however, a quantity of well-decomposed dung or seaweed ought to be forked in before winter.

If chards are required, when old plantations are to be destroyed, the plants should be cut over a little above the ground as soon as the principal part of the crop has been gathered; and when the leaves are about 2 feet high, they may be tied up and blanched like Cardoons.

In Italy, besides the head and chard, another product is obtained from the Artichoke; the stem is bent down at right angles, the leaf-stalks collected together, and the whole covered up to blanch. The result is a lump called *gobbo*, or hunchback, which is tender and palatable when eaten raw with salt. It is used in autumn and winter as a substitute for Radishes.

Except in very warm seasons the Artichoke does not ripen its seeds in this country. If, notwithstanding this, an attempt to save seed be made, the heads should be sheltered from rain by fixing sheets of glass over them or by gradually bending them down so as to throw off the wet. The seeds keep good for five or six years.

Varieties.—Although there are numerous named sorts in cultivation, only two or three are worthy of attention. The best undoubtedly is GREEN GLOBE (fig. 43), which has incurved scales. It is generally grown for the French and London markets, being very prolific and of excellent quality, but it is the least hardy of all.

PURPLE GLOBE is of medium size, of fair quality, and is very hardy and attractive-looking.

PERPETUAL.—Remarkable for its habit of growing and producing heads all the year round in climates favourable to it. Is largely grown in the south of France. The heads are purplish.

Fig. 43.—Artichoke—Green Globe.

ASPARAGUS (*Asparagus officinalis*).—A hardy perennial, native of Europe and Asia. Gerard says the manured or garden Asparagus is the same as the wild, but, like other vegetables, was made larger by cultivation; that it grows wild in Essex and in Lincolnshire, and in great plenty near Harwich. Phillips' *History of Cultivated Vegetables* says: "It is well known how much the Asparagus is improved in size since Gerard's time (1597), and it might be still further improved if our gardeners were to import roots of this plant from the borders of the Euphrates, where it grows to an extraordinary thickness. Pliny states that Asparagus, which formerly grew wild, was in his time carefully cultivated in gardens, particularly at Ravenna, where it was grown so fair and large that three shoots would weigh a pound. It is naturalized in America, near the coast, most probably from seeds which have escaped from garden plants."

Fig. 44.—Asparagus—Giant Dutch Purple.

The plant consists of a cluster of fleshy roots springing from the base of the stem, where a quantity of buds are formed, from which shoots annually push, and these in

their young and tender state form the edible part (fig. 44). The shoots, which are annual, attain a height of from 3 to 6 feet and bear numerous branches, clothed with small, linear, bright-green leaves. The flowers are small, star-shaped, and white, and the fruits are pea-like berries coloured bright red. Differences of soil, climate, situation, and cultivation have resulted in several recognizable variations, and it is probable also that seedling sports have been fixed. Accordingly there are numerous named sorts, the name usually indicating the district where the variety originated. The colour of the young stems depends greatly on the nature and texture of the soil; and with regard to size we may mention that in one part of Mr. Grayson's extensive plantations on the south side of the Thames the so-called Giant variety was produced, and in another part the common sort; but when both were made to change places, the common acquired the dimensions of the Giant, whilst the latter diminished to the ordinary size.

Propagation.—Asparagus seeds should be sown in drills on well-prepared soil where the plants may remain for one or two years before being finally planted out. The soil should be made as light as possible, so as to ensure a good tilth, and this may be done by incorporating leaf-mould, burnt refuse, and well-decayed manure. The drills should be not less than 14 inches apart and the seedlings thinned out to 12 inches. The seed should be sown about half an inch deep in April and thinned out when large enough to handle. Some gardeners sow the seed in small pots in May, and grow on the seedlings during the summer, wintering them under glass. They are planted out in beds the following April.

Soil and Situation.—A rich sandy alluvial soil, impregnated with saline matters, is naturally best adapted for the growth of Asparagus, and in such soil its cultivation is an easy matter. Soils of a different texture may be made suitable enough by treatment; but whilst the soil retains too great a degree of stiffness, the results of cultivation will not prove satisfactory, nor will the produce bear comparison with that from soil naturally well adapted for the growth of the plant. The large Asparagus from Argenteuil is chiefly grown on a sandy loam, and by a peculiar mode of culture, which will be presently described, and the cultivators think that on soil of this character the shoots attain a greater size than on very light sandy ground, but are produced on the latter more abundantly.

The situation for Asparagus should be open to the sun, and sheltered from strong winds.

Preparation of the Beds.—The effectual drainage of the soil should be the first consideration; for although the plant grows naturally in salt marshes, and therefore cannot be said to dislike moisture, yet moisture, to be beneficial, must be accompanied with heat. If cold rains occur in spring, after the beds are warmed by the sun and are in full cutting, growth and production will be arrested; but warm rains later in the season are, on the contrary, favourable in both respects. The plant requires warmth in the soil, and undrained soil retains the coldness of winter.

The ground should therefore be drained, trenched, or made good to the depth of 3 feet, and a large quantity of manure mixed with the soil; adding, near the top, such materials as the scourings of ponds or ditches, seaweed, decayed leaves or leaf-mould, turfy peat, charred soil, decayed hot-bed dung, all of which are excellent. Heavy crops of Asparagus are grown where the bottom is a yellow, rather heavy loam, and the top has been made light from long working and plentiful manuring. In trenching for Asparagus, the heavy subsoil is neither turned up nor mixed with the upper soil, as might be advisable for some crops; on the contrary, the lightest soil is kept uppermost, and made still more open by the addition of manure, sand, &c. Where the soil is not so deep, and the subsoil coarse and rather gravelly, the ground is trenched only one spit deep, the bottom of the trench being then merely dug over. Above this, however, a large quantity of manure is applied, and by this, together with good after management, chiefly consisting in making the soil fine and light for the shoots to push through, good crops are produced, but with greater care and expense than are requisite where the soil is naturally well adapted for the growth of the plants, that is, where it is loose and sandy.

A much-approved method of preparing ground for Asparagus is by cropping it with Peas, and when that crop is cleared off, Celery-beds 4 or 5 feet wide are marked out and excavated to the depth of a foot, the soil being thrown out right and left; then 6 or 8 inches of half-decayed leaves and dung, chiefly the former, and which had been used as linings to pits or frames, is trenched in at least a foot deep in the excavation. The surface is then covered once more with 3 inches of the best rotten

manure, which, when spread, is forked in and duly mixed. The bed is then planted with Celery, and when this is taken up for use, the operation, with a little care, leaves the bed right for planting Asparagus in the following May.

When preparing the ground it should be perfectly drained and well trenched, adding at the same time mortar rubbish, sand, and a liberal supply of decayed manure. A good deep friable loam is best for the bed. On heavy soil the bed should be raised about 1 foot above the level, as otherwise the shoots are weak and woody.

Artificial Manures.—The effect of these on the growth of Asparagus is exceedingly variable, and is greatly influenced by the greater or less dryness of the season. This was proved by the following experiments:—

Artificial manures were applied to separate beds, the surface of each being equal to 100 square feet, or about 11 square yards, and the resulting growth was estimated by the weight of stems produced, as compared with that from a bed to which no manure was given. The artificials applied, their respective quantities, and the manner of their application were as follow:—

Guano and Salt: guano 10 oz., salt 12 oz., in 16 gallons of water, applied once a week, for 17 weeks. Total—guano, 10 lbs. 10 oz.; salt, 12 lbs. 12 oz.

Sulphate of Magnesia, applied at once, spread over the bed in the middle of June. Total, 20 lbs.

Sulphate of Magnesia, applied in 16 gallons of water, once a fortnight, commencing in the second week of July. Total, 18 lbs.

Guano, applied like the preceding. Total, 18 lbs.

Salt, applied at once in the middle of June, like the sulphate of magnesia. Total, 20 lbs.

Nitrate of Soda, applied at once, like the preceding. Total, 20 lbs.

The following table exhibits the increase or decrease per cent in the weight of stems produced, the comparison being made with the bed that had no manure:—

	First Year.		Second Year.	
	Increase.	Decrease.	Increase.	Decrease.
No manure,	..	..	..	..
Guano and salt,	51	..	..	..
Sulphate of Magnesia, applied at once,	44	..	43	..
Ditto, once a fortnight,	44	..	..	37
Guano,	42	..	6	..
Salt,	22	..	..	..
Nitrate of Soda,	18	..	84	..
	221	..	133	37

It will be seen from this table that the increase in produce of the manured beds, over that to which nothing was applied, was, on the whole, much less in the second than it was in the first year; the latter was a wet season, whilst the former was very dry up to the end of the growing season—a circumstance which will doubtless account for the difference between the results obtained in the two years. Sulphate of magnesia, applied at once, gave the steadiest results, being an increase of 43 or 44 per cent in both years.

Taking the average of the two years:—

Nitrate of soda gave an increase of	51 per cent.
Sulphate of magnesia, applied at once	43½ „
Guano and salt	25 „
Guano	24 „
Salt	11 „

From the above it appears that common salt was inferior as a manure to the other substances employed. Of these nitrate of soda is at the head of the list, whilst salt ranks the lowest, the difference between the two being 40 per cent. It follows, according to the above experiments, that nitrate of soda should be employed in preference to salt. The latter, however, can always be readily obtained, and being of all artificial manures the one most frequently employed for Asparagus, it is necessary to say a few words respecting its application. It may be applied at the rate of 2 lbs. per square yard. This we consider a good dressing. The best time to apply it is in spring, before active vegetation takes place. It should be scattered over the bed, to be washed into the soil by the rain. Thus applied, it has the effect of ameliorating and rendering the soil more friable, so that the shoots can push through with facility. We have seen it more advantageously applied in this way than in repeated waterings with solutions. If weeds are troublesome, solutions, strong enough to kill them may also be occasionally employed in summer. For this purpose, independent of its manuring properties, salt is very useful; and it is also particularly so for the destruction of wireworms and other pests which injure the roots of Asparagus, and ultimately kill the plant.

Salt should not be applied to clayey soils, as it causes these to "run" badly, lowering of temperatures and summer-cracking being the effects; nor to plants recently removed, for all such, however carefully transplanted, must have wounded roots; and it is doubtless to its application under these circumstances that the injurious results which have in some cases followed its use are to be ascribed. Again, salt should never be applied when the plants are dormant, as

they cannot avail themselves of the nourishment it affords.

Planting.—This should be done in April, as it is not advisable to plant while the ground is at a low temperature, or before the plants show signs of growth. Care should be taken not to expose the roots to the air for any length of time. Ideal weather for the operation is that of a mild cloudy day.

An expert grower has stated, as an instance of the success of late planting, that after having made a new plantation with the greatest possible care, about the middle of March, he found that many of the plants had perished after planting. It was June before he could take any decided step to remedy the evil; he then procured several thousands of two-year-old plants, took up those that had not died, and, beginning entirely anew, had the ground dug over again, and replanted with the fresh plants, and although they had tops 8 or 10 inches high, scarcely one failed. "Many of the tops, indeed, withered and turned brown, but were in all cases succeeded by fresh growth. The plants were taken up carefully, the roots were immediately covered with moss, and kept moist till the moment of planting. In the course of the season the beds received several copious waterings with salt-water; and in the following spring, before the shoots made their appearance, the beds were sprinkled with salt sufficiently thick to make them white; the waterings with salt-water were repeated several times through the summer season, and by September the shoots were 5 feet high. Since the 15th of April we have gathered daily a good supply of fine shoots from these beds. It may appear that Asparagus planted in March, and having the whole season to grow in, must have a better chance of doing well than that which is transplanted in the middle of its growth; but I conceive that whatever advantages may arise from early planting are counterbalanced by the ground being cold and wet, and the roots of the plants being so tender that many of them perish before they start to grow."

In the Asparagus plantations near London the beds were formerly about 3 feet wide, and the alleys 2 feet. At the present time, many beds 5 feet wide with 2-feet alleys are laid down. We recommend that some of the beds should be 3 feet and others 4 feet wide. The reason for having some narrower than others is, that the narrow ones are sooner heated by the sun's rays, and consequently an earlier growth is induced.

The distance between the rows may be regulated as follows: Where the beds are 3 feet wide, two rows may be planted along them, each row being a foot from the edge of the bed; the rows will consequently be a foot apart. In beds that are 4 feet wide three rows should be planted, one along the middle, and one on each side, a foot from the edge of the bed. The distance from plant to plant in the rows should not be less than a foot; at this distance good-sized heads are produced, but if very large heads are desired, the plants may be 15 or even 18 inches apart in the rows. The beds should be traced out to run east and west, or so as to present the side of the bed to the direct action of the sun's rays when they are most powerful. In this way they have greater effect than when the end of the bed is presented to their influence; and the consequence is, that the shoots push earlier in the season than they do in beds running north and south.

Except for the earliest beds the direction is immaterial, and they may run east and west or north and south as may be most convenient. In proceeding to plant, the beds and alleys should be marked off at the required distance. A stout peg or small stake should be driven in at each corner of the beds, and from these the distances for the rows should be measured. Some good cultivators near the Thames, where the soil is loose, sandy, and light, make the beds 6 feet wide, and instead of being level on the top, and trenches or alleys being cut down between them perpendicularly, or nearly so, the top is rounded.

Where the soil is deep and easily worked and the subsoil is sandy or gravelly, raised beds may be dispensed with and Asparagus be successfully grown on the level. This method is gaining favour among market-growers who are unable to incur much expense in preparing the ground. Very poor ground ought to be bastard-trenched and liberally dressed with farmyard manure, mixing the manure with both spits. All things considered, it is best to plant 15 to 18 inches apart in rows 3 feet apart, and in the course of two or three seasons cutting may commence. Growing in rows admits of the crowns being easily moulded up with pulverized soil prior to active growth commencing in the spring; and this practice is desirable, as by far the best prices are obtained for stout shoots blanched to at least three parts of their full length. Dressings of manure or rich compost may, with advantage, be distributed along the alleys formed by moulding up, and liquid manure

can and should also be freely and frequently applied in the alleys.

There are various ways of planting ; some cut out a trench, as if for laying Box, deep enough to allow the roots to be spread out like a fan against the cut, the crown of the plant being kept 2 inches below the surface. Some dig out a trench, and at the proper distances form little hillocks of fine soil, over which the roots are spread. Others make a ridge, on the top of which they set the plants, spreading their roots on each side of the ridge ; and again, some take off a portion of the soil of the bed, and after the surface has been raked smooth, the roots of the plants are spread out on the level. In extensive plantations the first is generally practised, as it is the most expeditious, and answers very well ; but whatever method be preferred, the crowns of the plants should all be on the same level, otherwise those that are too high would be liable to be injured by the knife in cutting.

Good plants one year old are generally preferred, but some employ two-year-old plants or those that have been grown in pots. They should be carefully taken up with a fork, and the roots preserved as entire as possible. It is a good plan to stretch the line precisely where the Asparagus is to be; a slanting cut to be made sloping from the line, about 9 inches deep, and a similar cut on the opposite side of the line, leaving a sharp and angular ridge, across which the plants are to be set astride ; the operator, taking half of the roots in the one hand and half in the other, divides them across the ridge, at the distance of 12 to 15 inches between plant and plant. When finished they should be covered with about 3 inches of soil.

After-management.—During the summer and autumn the beds should be kept free from weeds, and to encourage good growth, especially in the first year, a dressing of well-decayed manure and leaf-soil should be spread thinly over the beds. In autumn any blanks that may occur should be marked with a view to filling them in the following spring. In November the old stalks should be cut off with a sharp pair of hedge shears and cleared away ; the beds should then have a good top-dressing with farmyard manure, covering it with soil thrown up from the alleys. This especially applies to light sandy soils.

Before active growth commences in spring, rake off any rubbish or stones, taking care not to disturb the roots or damage the crowns. Treat as before during the next two summers, taking the precaution of lightly staking up any extra strong shoots that form—allowing these to be broken down by wind and rain, or even to blow about much, being a great mistake—and in the autumn trim over the beds as before. It is unwise to commence cutting before the second or third year. If a start is made during the second year, only a few shoots should be cut, and those early in the season.

As Asparagus cannot well be grown too strongly, feeding from the surface should commence during the fourth season, and be closely attended to afterwards. The old-fashioned plan of giving a heavy autumn dressing of manure no longer meets with favour. Asparagus, unless actually on the surface, that is to say unduly exposed, is perfectly hardy, and is likely to be injured by a superabundance of solid manure. Chopping down the sides of the ridges and disturbing or breaking up the soil in the alleys again is a faulty practice, as it leads to the wholesale destruction of roots. A covering of about 3 inches of half-decayed manure acts beneficially in the case of light sandy soils, and this, in the spring, before growth commences, should be lightly forked

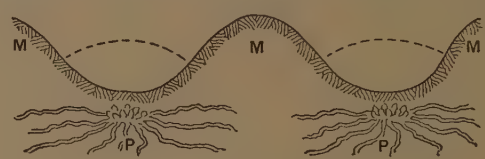

Fig. 45.—French Method of planting Asparagus. M, Mounds ; P, Plants. Dotted lines show method of earthing-up.

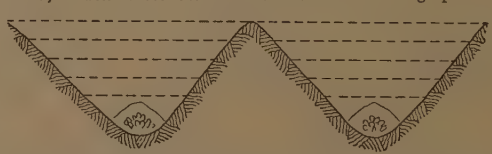

Fig. 46.—Another French Method of Earthing-up Asparagus. The dotted lines show the 4-inch layer of soil placed in the furrows over the plants each year.

over, all rubbish and stones being at the same time raked off and cleared away. In the case of heavier soils it is sufficient to loosen the surface of the beds in the spring, following this up with a top-dressing of light sandy soil and guano, or sulphate of ammonia or magnesia.

If long, partially-blanched shoots are desired, mound up over the crowns with fine light soil. The shoots are frequently spoilt by late frosts if the crowns are too near the surface. A covering of strawy litter over them is the best protection. Be careful not to top-dress with soil likely to contain seeds of weeds, nor to leave weeds

on the beds long enough to seed, or much after-trouble and labour will have to be faced. In the autumn, wait till the tops are quite dead before cutting them down, and with them clear away any large weeds that may be found.

Asparagus is extensively grown at Argenteuil, near Paris, for the markets of that city, and there Asparagus has become famed for its great size and excellent quality. It must be remembered that in general the object is to grow large stout shoots perfectly blanched, with the exception of the tops, which should be rose-coloured, red, or violet; but by allowing the shoots to remain longer uncut, or to be more exposed to the light, a greater length of edible shoot is secured. Asparagus is planted there in trenches instead of in beds. It is also frequently planted at wide intervals among the Vines in vineyards. At the beginning of winter the ground is dug 16 inches deep, and in February the ridges and trenches are lined off, if possible so as to run north and south. The first triangular ridge is only half the size of the rest, being 14 inches wide at the base, and 6 inches high. Two feet from the inner side of the base of this ridge a line is stretched, and a second line at 2 feet 4 inches from it, giving the base of the first full-sized ridge. This is to be a foot high. The whole of the ground is thus marked out in 2-feet trenches and 28-inch wide ridges alternately, the soil from the trenches being of course used to raise the ridges. The soil thrown up is intended to cover the shoots in the third year, previous to the first cutting, and, the same thing being repeated in the succeeding year, at the end of the fifth season the ground will be level. (See fig. 46.)

Planting is done in March or April. Holes 8 inches wide and 4 inches deep are made a yard apart along the middle of each trench, the earth in the centre of the hole being formed into a hillock 2 inches high, on which the roots of the plants are spread out equally in all directions. They are covered with ½ inch of soil, then with two handfuls of well-decomposed manure, and finally with an inch of soil, making a little hillock an inch high over each stool, and putting in a stick to mark the place of the plants, and prevent injury to the roots in hoeing.

In October the stalks are cut off at 6 inches from the surface, which is cleaned, the ridges dug a foot deep, and the plants manured. The roots having been carefully uncovered with a hoe over a circle 8 inches in diameter, one or two handfuls of well-decayed dung are placed over every crown, and covered with about 3 inches of light soil, raising a hillock 2 inches high over each, and marking any vacant places with a small stick.

In the second year the failures are replaced in March or April, with strong one-year-old plants, and stakes 3 feet long are pushed in slantwise at an angle of 45° near each plant. The ground is hoed at the beginning of April, and as soon as the shoots are large enough they are tied to the stakes to prevent breakage by wind. In October the withered stalks are cut off 8 inches above the ground, the ridges manured and dug over, and the stakes removed. The crowns are uncovered down to the manure, the soil about them loosened by the hand, and two inches of soil put on, always forming it into a conical mound.

In the third year, about the middle of March, mounds from 6 to 8 inches high are formed over each crown, according to its strength, but the plants used to fill up blanks are only covered 4 inches deep, and are afterwards left alone. In taking the shoots for use they are removed with the fingers so as to avoid injuring the stool, an asparagus knife only being used, if at all, to remove the earth and trace out the base of the shoot. The shoots are taken when 2 inches above ground, by passing one finger behind their base, and, by pressing the shoot aside, it is easily detached. The soil is then returned. At most only three or four shoots are taken from each stool. In April, stakes 4 feet 3 inches long are put in, and the stalks tied to them, and in October the withered stems are cut over 10 inches above the surface, and cleared entirely away, the ground cleaned, and a good dressing of manure given. In doing this the soil of the trenches is entirely cleared out to the depth of 4 inches, casting it on the ridges; it is replaced with half that depth of well-rotted dung, the withered stems are shortened, except one, which is left to show the position of the stool, and, after digging the ridges, the manure is covered with about 1½ inch of soil, at the same time raising a mound of 3 inches high over each crown, and marking with a stick any that are weak.

In the fourth year, mounds 10 or 12 inches high are formed over each plant, but the weak stools marked in the previous autumn are only covered half that depth. In May, when the ridges are hoed, some earth is drawn into the trenches, and stakes 4 feet 9 inches high are put in. In October the stems are cut over at 14 inches above the ground, the ridges are manured and

dug, the mounds in the trenches levelled, the soil in the trenches thrown out as in the previous year, some well-decayed manure placed over the crowns, and the mounds renewed.

In the fifth year the mounds are raised in March to about 14 inches high. The whole of the shoots of the strong stools are taken for use, but only a few from those which are weak. The shoots are removed for about two months daily, every second day, or every third day at most, according to the temperature, and when showing about 2 inches above ground, and of a red or violet colour. The plants are staked and securely tied, and in October the stems are cut over, the mounds thrown on the ridges, the trenches manured as in the third year, the ridges dug, and the manure covered.

In the sixth year the Asparagus will be in full production; it is mounded up 14 inches high from the crown, and the autumn treatment is the same as before.

Cutting the Stems.—In doing this a little of the soil is taken from beside the shoot with the Asparagus knife, which is then pushed down, but so as not to endanger the crown, or other shoots that may be pushing up; then turning the edge of the knife towards the

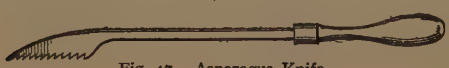

Fig. 47.—Asparagus Knife.

shoot, the latter is cut, or rather sawed off. It is the practice near London to cut off all the shoots as they appear, up to the period when it is thought proper to leave off cutting altogether, the period for doing this depending on the climate, season, nature of the soil, and strength of the plants. Where the climate is good, or when the season is an early one, cutting must commence early; and of course, in that case, it ought not to be continued late, otherwise the plants will be weakened. When Green Peas can be had, Asparagus is less required; so that, in the southern parts of the kingdom, the cutting may cease towards the middle of June, and in the northern parts by the end of that month. If the plants are weak, they ought to be allowed to grow up as early as possible to make foliage, and consequently fresh roots, and thus to acquire more vigour for the ensuing year. It is also advisable to leave off cutting, at an early period, some of the best of the beds formed for early produce, in order that the shoots may be well matured early in autumn, and that the young shoots may push vigorously early in spring.

Duration of the Plantation.—Asparagus beds in favourable soil will continue to bear well for many years if properly managed, especially as regards cutting; but if too severely cut they will soon become unproductive, however well they may have been originally formed, or however good their treatment in other respects. By continually cutting off all the shoots throughout the season, as they appeared, the plants would be completely destroyed, just as the most obstinate weeds would ultimately be if so treated. If a strong Asparagus root were allowed to mature all the shoots it produced, these of course would return organized matter for the formation of still finer buds, and production of a proportionate quantity of fresh roots. But if all the shoots are cut off as they appear, except one, perhaps, late in the season, sap cannot be elaborated for the proper maintenance of the whole of the roots, and consequently a portion of those least in connection with the shoot which is left will perish. If the same severe process of cutting is pursued the following season, the plant is almost certain to succumb. When blanks begin to appear in beds, the latter should in future be more sparingly dealt with. There is only one case in which severe cutting is excusable, and that is when the bed is about to be thrown up; then market-gardeners and others cut as long as the produce pays for the cutting.

The duration of Asparagus beds mainly depends on the manner in which cutting is conducted. If carefully done, the beds may continue in good bearing for from twenty to fifty years. It should, however, be remembered that to have fresh beds in bearing condition to supply the place of those past good yielding, three or four years must elapse from the time of sowing, and therefore it is not good practice to unduly delay the starting of new beds.

Seeds.—Some of the finest shoots which push in the early part of the season, and on the south sides of the beds, should be allowed to run up for seed. As the stems grow up, some of the most promising may be tied to stakes to prevent breakage by the wind; but in doing this care should be taken not to crowd the branches, in order that the foliage may be exposed to the light as freely and equally as possible. With the growth of plants so reserved, that of others adjoining should not be allowed to interfere. When at maturity the largest of the red berries should be selected. After lying a week or two they may either be squeezed between

the hands, and the seeds washed from the pulp, or the berries may be dried, in which case the seeds will keep the longest.

Forcing Asparagus (fig. 48).—This is an industry of some importance in the neighbourhood of Paris. It is also practised in a

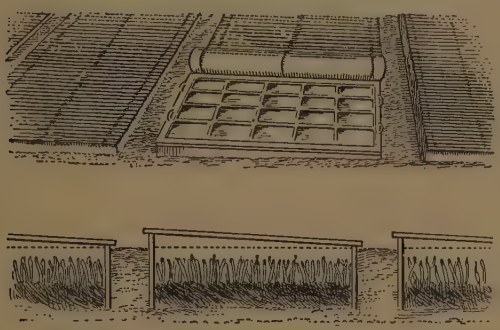

Fig. 48.—View and Section of Frames for forcing Asparagus (French Method).

few gardens in this country. The following account of the French method of forcing is taken from Robinson's *Parks and Gardens of Paris*: "The forcing alone of Asparagus throughout the autumn, winter, and early spring is an industry of considerable extent. In one of the most recently organized and active of these gardens about half an acre of glass is devoted solely to the forcing of Asparagus, and a supply is obtained from early in September to the end of April. It is forced in three ways—in houses heated with hot water; in frames in the ground and heated in the same way; and lastly, in frames covered with stable-manure. It appears to be forced with equal success in each case, though the stable-manure seems to offer the simplest means. As usual here, the frames are small, about 4 feet wide; the roots are placed directly on the manure, not flat, as they would be in the open ground, but packed as closely as possible, from 500 to 2000 plants, according to size, going under one light. A mere sprinkling of soil is placed over them. As a result the shoots come up very thickly. The plants are strong ones, three years old; as many as five crops of roots follow each other throughout the autumn, winter, and spring in the same frame. The universal straw mat is used to cover the frames at night."

The old mode of forcing Asparagus, still practised to some extent, chiefly consists in digging deep trenches between beds planted for the purpose, covering the beds with the soil and with frames, filling in the trenches between the frames with stable-manure, and protecting the frames with straw mats and litter to keep in the heat. In the beginning of November the pathways between the beds of Asparagus are dug up about 2 feet in depth and width. The soil coming from the pathway is divided very carefully, and put about 8 inches thick upon the surface of the bed. The trench is filled up with new stable-manure, not litter, and frames placed on the bed. The manure should rise as high as the top of the frames, and the lights be entirely covered with mats and litter to prevent the accumulated heat from escaping. The sashes are put on, and no air is given; on the contrary, they are covered at night with straw mats, and also during the day in cold weather, a temperature of from 60° to 75° being considered desirable. We should, however, prefer starting with a temperature of between 50° and 60°, as is done by means of hot-water pipes in the Royal Gardens at Frogmore. The heat may be increased so as to range between 60° and 65°, or not exceeding 70°; for it is found that when Asparagus is forced too rapidly it is not so good as when it is brought forward gradually, with a temperature resembling that of a very fine May. Where glass is used, a good deal of sun-heat may be economized by keeping the sashes closed till the shoots appear. In the open air the finest and most tender shoots are produced in beds that have been exposed to powerful sun-heat.

In about a fortnight or three weeks the Asparagus begins to show itself on the surface of the bed. Many market-gardeners cover the whole of the bed inside the frame to a thickness of 3 or 4 inches with manure to force the vegetation more quickly, but in this case the manure must be removed when the Asparagus begins to shoot. When the shoots are about 3 inches out of the ground they may be cut. The mats must be taken off in the day-time, but the heat must be well kept up, or the roots and buds will fail to push. The beds are forced every second year only. The gathering of the Asparagus may continue for about two months, but no longer, or the plantation would be injured. When the gathering is over, the frames and linings may be taken away, and the soil taken from the alleys put back again.

When the trenches are partially filled up after forcing is over, and the dung turned out, the roots strike into the decaying substances usually employed, so that when the beds are again about to be forced, these roots are destroyed in clearing out the trenches for the reception of the dung, and they are generally the most vigorous. This

proceeding, in fact, deprives the plant of its most efficient feeders at the time they are most wanted. It is better to keep the trenches open, so as not to encourage the roots in that direction. In this case it would be well to cover over the trenches, in order to prevent the soil of the beds from being dried. In some instances the sides of beds intended to be forced by dung-heat have been faced with bricks in the pigeon-hole fashion, and where it can be afforded this plan answers very well.

In some places it is difficult to procure dung for the purpose of forcing, and in any case it is doubtful whether heating by hot water is not cheaper in the end. The labour required for working dung linings is very considerable, and would go far towards defraying the expense of fuel. At all events the hot-water mode answers well where it has been adopted, as, for example, in the Royal Gardens at Frogmore. The beds there are 75 feet long and 7 feet wide ; their sides are formed with pigeon-hole brickwork, and the spaces between the beds are 4 feet deep ; but the lower half is filled with rich soil, and in the upper half there are a flow and a return pipe for hot water, connected with a boiler which heats six ranges of flow and return pipes. The cavities for the pipes are covered with Yorkshire stone, and the beds themselves with a close-fitting wooden roof. Some think 7 feet too great a width for the beds ; we should recommend 6 feet ; and where such substantial covering as Yorkshire stone cannot be afforded, wooden covers will answer the purpose. At Frogmore forcing is usually commenced in December, and a supply obtained in about a month. A little air and light, when the shoots begin to reach the surface, much improve their flavour and appearance. In every case avoid forcing every growth out of the crowns, as it is important that the plants should grow as strongly during the summer as those not forced. Do not wholly withdraw all the protective material directly forcing ceases, but keep the beds littered over till all danger from severe frosts is past. These forced beds should also be very liberally treated as regards feeding, liquid manure during the growing season doing excellent service.

Forcing lifted Plants.—As yet there are few places where Asparagus in permanently planted beds is forced, the more convenient practice of lifting and forcing plants prevailing. Nor do many growers prepare a stock of plants specially for forcing, probably because this cannot well be done under two or three years. Those, however, with plenty of garden room would do well to prepare a few thousand plants for forcing, as the produce from strong young plants is usually very superior to that obtained from old plants. Ground that would grow good Potatoes would suit Asparagus. Either sow the seed thinly in drills 18 inches apart, eventually thinning out to a distance of 12 inches apart in the rows, or else plant 1-year-old roots at the same distances apart. Keep them free from weeds, mulch before dry hot weather is anticipated, and then nothing but poverty at the roots will prevent a strong growth.

In most large gardens a fresh bed is formed every spring, the oldest bed being broken up for forcing. If the beds are well prepared, and fresh sites chosen each time, this gradually brings a garden into a highly cultivated state.

The plants for forcing should be carefully lifted, enough being taken to fill a two-light or three-light frame, or the same number of lights in a pit to be forced at one time, unless a large supply is wanted at any particular date, in which case a period of from 15 to 30 days, according to the time of year, should be allowed, a close succession to be kept up by means of fresh relays of plants every fortnight or three weeks. Seeing that it is impossible to lift when the ground is frozen, severe frosts should be anticipated either by lifting a good supply of plants and storing in fine moist soil under cover or else by covering the beds with strawy manure. Asparagus forces readily in pits, bottom-heat being afforded by a gentle hot-bed of manure and leaves, and top-heat by means of hot-water pipes. It can also be forced successfully in ordinary frames on mild hot-beds. Keep the lights close, and mat over heavily till the shoots are coming up freely, when a little light and air during mild days should be admitted. Force all the growth out of the plants, and then throw them away as being no longer of any value. Divide the shoots into grades, according to size. The smallest shoots may be used in soup-making.

Green or even blanched Asparagus may be produced in any forcing-house, in a temporary pit formed of wood, or in boxes. The latter may be made so as to rest one above the other, in order to occupy comparatively little base room. They may be 2 feet wide, 3 feet long, and 1 foot deep, with an upright 20 inches long secured inside the box in each corner. The uprights, standing 8 inches above the upper edges of

the box, will serve as posts for supporting another similar box, and leave space for the growth of the shoots and for cutting. In this way four or five tiers may be placed along the back wall of a vinery or other forcing-house at work.

Amongst the newer selections that have specially come to the front is Chelsea Giant, a most prolific grower of large size and good quality.

Insects, &c.—See chapter on this subject.

Leaf Enemies.—Garden Pebble Moth.

BALM (*Melissa officinalis*).—A hardy perennial, native of south Europe. Its young shoots are sometimes employed in salads instead of Parsley. It is also used for making a decoction known as Balm tea.

It prefers a light warm soil, and is propagated by division early in spring. The subsequent culture is confined to keeping the ground free of weeds, and stirring it occasionally ; the stems should be cut down when frost sets in ; by these means the plants will remain vigorous for many years. When coming into flower some stalks should be gathered and dried for winter use.

BASIL (*Ocymum basilicum*) (fig. 49).—An annual, a foot high, native of India.

Fig. 49.—Basil.

The aromatic leaves are used in soups, &c., and occasionally in salad ; but their strong flavour is disagreeable to some persons. The Bush Basil (*O. minimum*) is the smaller and the more hardy of the two. They are both raised from seed, which should be sown in gentle heat in April, and the young plants thinned out to about 3 inches apart. Plenty of air and frequent waterings should be given in mild weather, transplanting them to the open ground in May in a warm border. The larger sort may be planted 9 inches from plant to plant, in rows a foot apart. To prevent slugs place around each plant finely sifted cinder ashes. When growth is completed the plants may be pulled up by the roots, tied in small bunches, and hung up to dry in an airy shed for use in winter.

BEAN (*Vicia Faba*).—A hardy annual of obscure origin, but possibly Egyptian ; at any rate it is known to have been cultivated by the ancient Egyptians, and also in Europe in prehistoric times. It is now largely cultivated, and is popularly known as the Broad Bean.

Soil.—The Bean has a long tapering root, extending downwards in a perpendicular direction to a considerable depth. Shallow soils are therefore not well adapted for it. That which is most suitable for the main crop is a deep, well-drained, rather strong loam ; but for the first crops a light warm soil should be chosen. It has been found by analysis that the Bean contains a large amount of nitrogen ; hence a soil rich in decaying animal or vegetable matter is most suitable for it.

Manures.—As Beans in garden culture are gathered young, it is obvious that manure ought to be given so as to be serviceable to the plants at an early stage of their growth. Lime, marl, gypsum, superphosphate of lime, bone-dust, wood-ashes, and burned clay will each and all prove highly beneficial to Beans on soils that have long been under cultivation and manured with organic manures. As lime and gypsum require a considerable time for solution, they should be applied in the autumn, and the other manures in spring. Although farm-yard manure may in general be the best manure for Beans, yet in cases where the ground is already rich in organic matter its application will not be attended with such good results as would follow the use of lime, potash, magnesia, soda, &c. On the other hand, when the soil is deficient in vegetable matter, but abounds in mineral substances, the application of such will not be so beneficial as that of organic manures.

Seed Sowing.—Beans are generally sown in drills, 2½ feet apart and 3 inches deep. The seed should be placed singly, 8 inches apart in the drills, and then covered with soil, which should be made firm. Many cultivators sow the seeds in double drills, 10 inches apart, the rows being not less than 3 feet apart.

When the plants are about 6 inches high they should be earthed up, placing at intervals of about 9 feet on each side of the rows stakes to which lines of string can be fixed throughout to keep the stalks in position. When the plants are well set with fruit, remove all side growths, pinch out the growing points to check the upward growth, and cause the pods to swell. This operation reduces the chances of an attack of Bean Aphis; the tops when removed should be burnt.

Beans in Pots.—Satisfactory results may be obtained from seed sown in 8- or 10-inch pots in November and placing them in a cold frame, afterwards bringing them into a fruit house for April and May. They require plenty of moisture, and as airy a position as possible to assist them to set their flowers. To succeed them a sowing may be made on a warm border in front of a south wall or close hedge.

A small sowing should be made in the beginning of November. If the winter is mild the plants will require little or no protection; but if likely to be severe a covering of litter or leaves, or a mixture of both, should be put between the rows to keep the ground from freezing.

Beans transplant well, and their safety through the winter may be ensured by sowing them in November, in rows from 4 to 6 inches asunder, in light soil and in a warm situation, where they can be easily protected by means of frames, straw screens, mats and hoops, or similar contrivances. In protecting, care must be taken that the plants do not suffer from want of air and light. They will be fit for transplanting into a warm border on a mild day in February; or the seeds could be sown in boxes early in February, and placed in gentle heat to germinate, hardening off, and planting out the seedlings on an early and favourable opportunity. Most cultivators defer making their first sowing until early February, and a warm border is selected. The seeds should be planted in rows not more than 3 feet asunder, and fully as deep in the soil as they were before removal, afterwards drawing a little earth to the stems, and topping, as previously directed, for the main crop.

Long Pod may be sown in March for the principal crop, and again in April and May for succession. For a late crop the Windsor type should be sown in June or the beginning of July.

To obtain a very late crop, after gathering the summer produce of the Long Pod in a young state, let the soil be well watered, if dry, and in two or three days after the watering let the stems be cut down to within a few inches of the ground. Fresh shoots will soon push, and a better very late crop will be produced than if seeds had been sown late for the purpose. If a late crop is a very special object, then the plants intended to produce it should be cut down when in flower.

Gathering.—Some prefer Beans when very young, or when they have attained only one-fourth of their natural size. They should at all events be gathered before they appear black-eyed, that is, black at the hilum, or point of attachment to the pod. A portion, however, should be allowed to get older, in case they should be wanted for soups.

To save Seed.—The sorts of which seeds are intended to be saved should be sown in the end of February; and as the best seeds are those in the first-formed pods, none of these should be gathered for cooking green, although those produced afterwards near the top may be taken with advantage to those which are left below to ripen. When the leaves become withered and blackish, the stems should be pulled up, tied in small bundles, and set upright, where they will dry by exposure to the sun and air. The seeds will keep good for two years, after which time they are not to be depended on, though some will retain their germinating powers for five years or more. Seeds that have been long successively saved from plants grown in the same soil and situation are liable to degenerate. It is therefore advisable to obtain a supply occasionally from a different soil and climate.

Enemies.—Bean Beetles, Black Aphis, Pea and Bean Weevils, Silver Y-Moth, Mole Cricket. See chapter on Insects, &c.

Beck's Dwarf Green Gem.—Stems 1 to 1½ foot high, branched, compact in growth; pods small, abundant, clustered, 3 inches long, containing about three small fine green Beans. A most prolific variety, later than Longpod, very desirable for small gardens.

Carter's Leviathan, one of the best of the Longpods, valued for its cropping quantities and quality.

Green Leviathan.—A green-seeded counterpart of Longpod, and one of the most remarkable and popular sorts ever raised. Has long straight pods, and Beans excellent in flavour.

Green Longpod.—Stems 3 to 4 feet high; pods 4 to 5 inches long, mostly erect, generally containing about four oblong Beans, which when fit for use are bright-green. Much valued for their green colour when cooked.

Longpod (fig. 50).—Stems 2 to 3 feet high, of free growth, branching at the ground and pro-

ducing from three to five stems ; pods 7 inches long, containing from three to five medium-sized Beans of good quality. Prolific and early.

SEVILLE LONGPOD.—Stems 2 feet high, sparingly branched ; pods often 7 to 9 inches, containing about six Beans of excellent quality ; the pods are rather sparingly produced. One of the earliest.

Fig. 50.—Bean—Longpod.

WINDSOR (Broad Windsor).—Stems 3 to 4 feet high, branched, robust ; pods 4 to 6 inches long, 1½ inch broad at the lower end, much curved, containing two or three very large roundish flattened Beans. An excellent sort, the best for a summer crop. *Green Windsor* has the habit of the Windsor, and Beans of a green colour.

BEET (*Beta vulgaris*).—A hardy annual or biennial, native of the sea-coast of the south of Europe. Its cultivation does not date from more than three or four centuries before the Christian era. The red and white roots were known to the ancients, but the number of varieties has greatly increased in modern times, especially since the Beet-root has been cultivated on a large scale for the food of cattle and for the production of sugar. It is one of the plants most easily improved by selection, as the experiments of Vilmorin have proved. According to the late Mr. Barr's observations the purple-fleshed sorts are the richest in flavour, the crimson-fleshed sorts being also good ; those with scarlet flesh contain least saccharine.

Beet requires an exposed, sunny situation, for, however good the soil may be, it will not thrive if shaded by trees. A tolerably rich open loam, or a sandy loam, produces the cleanest roots and the best crops. Ground that has been manured for a previous crop will not require to be again manured for Beet. It should, however, be trenched in winter two spades deep, throwing the soil in ridges in order to expose it to the action of the weather. Advantage should be taken of dry weather to level down the ridges, and dig the whole regularly over just before sowing.

If manure is necessary, it should be applied in trenching, putting it down a foot or so below the surface, an early contact with solid manure causing the roots to fork badly. Salt has a decided effect in promoting the growth of Beet, especially on light soils ; but it should only be applied in moderate quantities, as both it and ammoniacal manures, when too liberally given, have the effect of increasing the bulk of the produce at the expense of its quality.

In most localities the main crop may be sown about the third week of April. The precise time, however, depends on the soil and situation. In some soils the plants are apt to run to seed in the same season ; the sowing should therefore be made later than where the plants are not subject to run. The market-gardeners near London sow their Beet in the first week of May ; for if sown as early as some recommend, the roots become too coarse, and are not so tender as those sown later. On the other hand, it may be sown too late to acquire its proper size and flavour. In gardens where early crops must be raised, it will be advisable to sow some early kind, notably the blood-red form of Turnip-rooted, at the end of March on a south border that has been well worked the previous season. For succession, a few more rows, according to the demand, may be sown at the end of April.

The seeds should be sown in drills 1½ inch deep ; these for the smaller kinds should be about 12 inches apart ; and the plants should be thinned out to 8 inches apart in the row. The large sorts may have 15 inches between the rows, but still not more than 8 inches from plant to plant in the row.

When the plants are 2 inches high, they should be thinned ; and when they have made six leaves, again thinned to the proper

distance. At this age the thinnings may be used for filling up any blanks in the rows. Great care should be taken not to break the roots in removal, and the principal one should be inserted at full length, and without doubling. This should be done in cloudy weather, and when the ground is moist but not wet. The soil should be frequently stirred during the summer, and light applications of some approved artificial manure may be given. This is best applied in showery weather, hoeing it in the following day.

The crop on nearing maturity should be lifted at intervals, the final lifting to be done

Fig. 51.—Leaf-Beet—Green or Spinach-leaved.

on the first signs of frost, certainly not later than the middle of October. Care should be exercised in this operation to avoid breaking the fibres, for loss of colour will result if these are damaged in any way.

Before storing the roots the top should be twisted off, not broken or cut too near the end. The roots are then laid slanting in moderately dry sand so that the herbaceous part only of the crown is exposed in an open shed protected from frost. They should be looked over at times, and must not be allowed to become dry, otherwise the quality deteriorates.

To save Seed.—Sow in an open situation according to the quantity required, and thin out the plants to a foot apart, leaving those which appear the finest and true to the variety. Give protection from frost in winter, and secure their stems in the following season from breaking by wind. Instead of sowing seeds for the purpose, a few roots of the finest of the main crop may be taken up and replanted in spring. Seed should not be saved from plants which run to flower in the year of sowing.

Forcing.—Beet-root will not bear hard forcing, but it can be raised under glass in frames placed on beds made up of leaves and strawy manure. Nothing is more pleasing in the early spring than a dish of young fresh Beet. The frames should be filled to within 10 inches of the top with about 15 inches of a compost, 2 parts loam, 1 part leaf soil, and 1 part road sand, making the bed moderately firm, a loose root-run promoting leaf growth. Afterwards the seed may be sown in drills 10 inches apart from the middle of January onwards; and as soon as the seedlings are large enough to handle, thinning should be done, allowing about 6 or 8 inches between the plants. Beet under glass requires plenty of air on all favourable occasions, and careful watering, especially in the early stages of growth, but on no account should they become dry. When they are well established give air freely on mild sunny days, even removing the lights for a few hours. Eventually the lights may be left off altogether. In this way a supply of Beet may be maintained until the crop outside is ready. One of the best to force is Crimson Ball.

Leaf-Beet (*Beta Cicla*), a native of the sea-coasts of Spain and Portugal, is cultivated for its leaves and leaf-stalks, chiefly for

Fig. 52.—Beet—Dell's Crimson.

the latter; the roots being hard, much divided, and unfit for cooking. Sow the seed in March in boxes of prepared soil, and

Fig. 53.—Beet—Sutton's Blood-Red.

place in gentle heat, pricking out the seedlings in other boxes before finally planting them out in the open ground, in an open position, allowing about 18 inches between the plants and 2 feet between the rows. They should be ready for use from July onwards. The green parts of the leaves are treated as Spinach and the mid-ribs as Asparagus or Sea-kale, being cooked in the same way. The varieties are Silver or Sea-kale, Yellow-stalked, and Red-stalked, the first-named being the most serviceable. Red-stalked and Yellow-stalked are attractive, owing to their bright colours. A perennial variety of Beet is grown for its leaves, which take the place of Spinach, and is known as Spinach Beet. It is easy to cultivate, growing well in trenched, manured ground. The seeds are sown about the middle of March, allowing 18 inches between the rows and 12 inches from plant to plant; the ground should be well hoed at intervals. The plants require little other attention beyond this. The leaves should be gathered before they get too old.

Enemies.—Beet Carrion Beetle, Beet Fly, Silver Y-Moth, Turnip Fly, Daddy Long-legs, Dart Moths, Pot Herb Moth. See chapter on Insects, &c.

The principal garden varieties of Beet proper are :—

Carter's Crimson Ball.—Roots round, dark red, fit for use in midsummer if sown in March, and for succession till winter. Flavour excellent.

Carter's Perfection.—The best long Beet, of medium size, rich crimson colour, and excellent flavour. Its foliage adds greatly to the attraction of the kitchen garden.

Cheltenham Green-Top.—Leaves green, roots 6 inches in circumference, with a conical crown; flesh bright-red, of excellent flavour.

Crimson Ball.—The foot-stalks 5 or 6 inches long, pale, tinged with purple; root purplish-red; it is tender and free from fibres, and early in the season is excellent.

Dell's Crimson (fig. 52).—Leaves rich dark glossy-crimson, of uniform medium height, compact and slightly arched; roots 9 inches in circumference; flesh purple; a first-rate table kind.

Dobbie's Purple.—Much esteemed for the colour of its root and quality, a splendid type of dark red Beet.

Nutting's Dwarf Red.—Leaves 12 inches high, dark blood-red; roots 9 inches in circum-

Fig. 54.—Beet—Sutton's Globe.

ference, with a conical crown; flesh purplish, sweet when cooked, the flavour excellent.

Sutton's Blood-Red (fig. 53).—Roots of medium size, deep red, of first-rate quality. Leaves dark crimson. One of the best long-rooted sorts.

Sutton's Globe (fig. 54).—Roots round and Turnip-like, deep red, maturing quickly; best when used before they are full grown. Does well when sown in July for a late crop.

BORECOLE, or Kale (*Brassica oleracea acephala*).—The Borecoles constitute one of the hardiest divisions of the Cabbage tribe, and on this account they are useful in northern climates for the supply of winter greens. They thrive in any garden soil if provided with plenty of manure. For a north border the Dwarf Curled is the most suitable. The main crop should be sown in the first week of April, or, in the northern parts of the kingdom, in the third week of March. An open medium soil should be chosen, which has been well worked during the winter and received a dressing of lime, which prevents the disease known as Club-root. The beds should be raked over as finely as possible. The varieties should be sown in separate beds, carefully labelling and netting, as the birds are troublesome at this time of the year. Encourage the seedlings by thinning if necessary, as they should not be allowed to get overcrowded in the seed bed. They are all the better for pricking out in some spare position where they will enjoy light rain, planting them in their final quarters before they become drawn, so as to secure sturdy plants able to withstand cold. If good varieties are chosen and well grown they will stand a severe winter. They should be planted out in showery weather if possible; if not, the plants should receive a good watering at the time of planting. Ground that has been cropped with early peas is an excellent site, as it is moderately firm, which is essential to sturdy growth. In all cases sufficient room should be allowed for the crops to become hardy. The peas will afford shelter from the sun's rays until the plants are well established.

Planting.—The distance of planting will depend largely on the variety and the conditions of the soil. A good distance is 2½ to 3 feet between the rows and not less than 2 feet between the plants. When planting select only seedlings free from Club-root, planting them firmly and sufficiently deep to hold them in position. The soil should be carefully forked over afterwards.

In gathering, the heads of the Dwarf and Tall Borecoles should be cut first; the stem will then push fresh lateral sprouts.

To save Seed.—This is an easy matter; but to save the varieties true to their kind is difficult, the different varieties of the Brassica tribe being so liable to cross in consequence of the pollen being carried from one variety to another by bees, flies, or other insects, or even by the wind. It is therefore not sufficient to net the seed-plants, so that bees cannot reach the flowers; it is even questionable whether the reverse of what is intended is not occasioned by so doing, for the bees in hovering above the netting will lose some of the pollen brought on their hairs from flowers of other plants of the Cabbage tribe, and that falling amongst the plants frequently effects a cross. By selecting plants of the best characters, and planting a dozen or so together, we have known a very fine Dwarf Curled Borecole saved perfectly true for many years. The plants for seed should be taken up early in spring, and planted rather deeply in a spot well exposed to the sun, in rather sandy soil. They should be watered moderately, and the stems supported to prevent breakage by wind. When the seeds are ripe they should be rubbed out, cleaned, dried, and stored in a dry place.

Insects, &c.—See under Cabbage.

Asparagus Kale (Manchester Kale, Camberwell Kale).—Stem 18 inches to 2 feet high, producing numerous side shoots in spring, which are tender and of good quality. Leaves purplish, somewhat glaucous, smooth, bluntly toothed. A very hardy and valuable late variety.

Carter's Russian Kale.—Distinct, extremely hardy, leaves thick, green, and of good quality.

Chou de Milan.—Stem 2 feet high; leaves bluish-green, rugose, forming an open crown. In February and March a number of open sprouts are thrown out along the stem, and these when cooked are of rich and delicate flavour. Closely allied to the Cottagers' Kale.

Cottagers' Kale.—Stem about 2 feet high; leaves plain or curled, some green, others purplish-green. The plants throw out an abundance of shoots in spring, and furnish a useful supply of greens. One of the hardiest and most popular.

Fig. 55.—Borecole—Dwarf Green Curled.

Dwarf Green Curled (Green Scotch Kale) (fig. 55).—Very hardy, dwarf, liable to be completely covered with snow, and thus protected

when the taller kinds are either destroyed by frost, or rendered so tough as to be unfit for use.

Dwarf Purple Borecole.—Merely a form of the Tall Purple, distinguished by its dwarf habit.

Imperial Hearting or Cabbage Kale.—Resembles the Dwarf Green Curled in the nature, colour, and general appearance of its leaves; the heart-leaves, however, fold over each other, somewhat like those of a Cabbage. The quality is excellent.

Labrador.—Withstands the winter when other varieties fail; also affords the best greens late in the season. Is of dwarf and branching habit.

Ragged Jack.—Dwarf, leaves glaucous, deeply cut, often curled, not hairy when young. Of good quality, and very productive.

Tall Green Curled (Tall Scotch Kale) (fig. 56).—Height from 2 to 3 feet; capable of enduring a considerable amount of frost, and, like the preceding, affording the best greens from the time the first frost has mellowed its flavour to the middle of February. The quality is improved by frost, but impaired by dry frosty winds.

Fig. 56.—Tall Scotch Kale.

Thousand-headed Kale.—Allied to the Tree Cabbage, but does not grow so tall, and is therefore preferable to it.

Tree Cabbage (Great Cow Cabbage, Jersey Kale).—This grows to the height of 6 feet, and in La Vendée and Jersey it is said to attain the height of 12 feet. The leaves are large, smooth, or but slightly curled; its sprouts are said to be good when cooked.

Variegated Borecole (Variegated Plumage Kale).—A tender form of the Purple Borecole, the leaves richly variegated; sometimes green and yellowish-white, green and purple, bright-red, purple, or green. It is occasionally employed for garnishing; is very good cooked after frost. Melville's Variegated Kale is another form, variously curled and fringed with green, red, or purple.

BROCCOLI (*Brassica oleracea* var. *Botrytis*).—A cultivated variety of the wild Cabbage. It is not so hardy as many others of the Brassica family, in this respect resembling the Cauliflower. The difference between some of the varieties of Broccoli and the Cauliflower is scarcely perceptible. Miller suggests that the Broccoli known in his time was derived from the Cauliflower, which he states was imported from the island of Cyprus. He speaks of White and Purple Broccoli as coming from Italy. On the other hand, the Sprouting Broccoli is supposed to be the parent of the Cauliflower and the true Broccoli.

Sowing the Seeds.—With a selection of modern varieties it is possible to keep up a supply from the last cutting of Cauliflowers in late autumn until the spring. Near London, seeds of the early kinds are sown about the 10th of May, and the late kinds in the second or third week of April. Nothing is gained by early sowing, and often much is lost, owing to the plants having to stand too long in the seed-bed. Leggy plants are among the first to succumb to frosts, this being another objection to early sowing. The spring kinds should be sown in the middle or end of April. Of such varieties as Michaelmas White, a small sowing may be made in March in cold frames to follow Cauliflowers; it can also be included in the main crop varieties. The seed-beds should be located well in the open—not at the foot of a garden wall. Seedlings should be transferred to their permanent quarters as soon as large enough, as it is a mistake to allow them to remain in the seed-bed to get weak and leggy. The soil should be moderately firm so as to ensure sturdiness of growth. They should be allowed 2½ feet between the rows and 2 feet between the plants, well watering them at the time of planting. Examine the transplants carefully to see that each has a central bud or growing point, rejecting those that are blind, also any with small knobs on the roots, which indicate the presence of club-root disease. When the plants become established lightly fork the ground over, and afterwards keep it well hoed and free from weeds.

Broccoli succeeds best in a good loamy soil. In such it may not grow so large as in that which is very rich and highly manured, but the quality is finer, and the plants are not so liable to be attacked by club as in richly manured soil. Where this disease may occur the ground should be dressed with quicklime. For autumn sorts the

ground may be highly manured; but if made too rich for winter and spring sorts, the plants will be more liable to injury by frost than those less stimulated. It has been ascertained that in severe winters Broccoli growing in the open field have not been injured; whilst those of the same sort planted in a well-sheltered garden have been nearly all killed.

With regard to stimulants, stable-manure is probably the best; but in some cases other substances may be applied with advantage. In gardens that have been long cropped with vegetables, marl will be an excellent application for this crop. Lime may also be mixed with the soil in digging, or applied occasionally, and when newly slaked, to the surface of the ground; but not after the heads begin to form. Flowers of sulphur dusted on the roots when transplanting will serve to prevent mildew; common salt and nitrate of soda may be used with advantage in killing worms or grubs which attack the stem and roots. Guano is a powerful stimulant, but it produces a rank growth; and though the produce may be large, the quality is not so fine as that obtained where marl is applied.

Loose, rich ground promotes leggy, sappy growth; a firm or almost solid root-run is therefore preferable, as this tends to keep the plants sturdy and hard. A start should be made with young plants direct from the seed-bed, firmly fixed with the dibber, and not crowded. In some districts the hardiest, if not the finest, Broccoli are grown on land just previously cleared of either Early Peas or Strawberries, both crops usually leaving the ground in firm condition. The surface is merely hoed over and all rubbish removed. Drills are then drawn with a heavy hoe, and, if dry, given a good soaking with water or liquid manure, soon after which planting may be done with a dibber. Some gardeners make the holes with a crowbar, and thereby secure good Broccoli even after severe frosts.

Fig. 57.—Broccoli—Leamington.

Occasional waterings may be required in dry weather, and a mulching of decayed farmyard manure should be given. To keep the heads white and clean cover each over with leaves from plants that have been cut, to prevent them from becoming yellowish through exposure.

Protection in Winter.—Although most of the varieties of Broccoli are hardy enough to resist a few degrees of frost, some even withstanding severe frosts, yet we occasion-

ally experience winters that cut off nearly every kind, especially if they have not been grown as hard as possible. This loss can be prevented by taking up, on the approach of frost on a dry day, those which have either formed or are just beginning to form heads and placing them side by side on the floor of a cellar. Or lift them with some soil about their roots and replant them firmly and somewhat closely in rich moist soil, where they can be readily protected with mats and litter. Empty pits in vineries at rest, peach-houses, and such like, as well as ordinary brick pits and deep wooden frames, are suitable for this purpose, and if the plants are moved before severe frost cripples them there will be a good supply of small heads till midwinter or later.

Taking the Crop.—Broccoli, for some tables, is cut when not larger than a cricket-ball; for others it is preferred when full-grown; but in no case should it be allowed to remain till the compactness of the head is broken. It should always be cut whilst the curd, as the flowering mass is termed, is entire, or before bristling leafy points make their appearance through it. In trimming the head a portion of the stalk is left, and a few of the leaves immediately surrounding the head.

To save Seed.—Select those plants that in leaf and flower are most characteristic of the variety. Some allow them to remain where they have grown; others prefer transplanting them carefully, supplying them regularly with water during the summer. Those plants which have a disposition to produce large and coarse leaves should be rejected. For early sorts, the smallest plants with the least undulated leaves may be selected and planted out late in the season, and afterwards lifted and replanted in fresh soil, in order to retard their flowering till next spring.

Insects, &c.—See under Cabbage.

Carter's Mammoth Spring White.—A splendid variety, well known for its earliness. Heads snow white, and of the finest texture.

Cattell's Eclipse.—A sturdy dwarf sort, with short broad leaves, the inner ones forming a good protection to the compact white head. One of the latest and best.

Chappell's large Cream-coloured.—A very large sort, which comes in earlier than the Portsmouth, and continues throughout the winter. Sow about the middle of April and first week in May.

Grange's Early White (Bath White).—One of the earliest of the white kinds. Sown in the first and third weeks of May, beautiful heads are produced in October, November, and December.

Knight's Protecting (Frogmore Protecting).—One of the hardiest of the white sorts, excellent when true, but is apt to degenerate. The leaves are twisted, so as to encompass and protect the head, which is very large and white. Sow in the third week in April and second week in May. The parent of many late white varieties.

Late Queen.—One of the best of the late section, very hardy, compact in growth. Sow in April.

Latest of All.—Very hardy, late, and reliable, usually at its best in May. Its leaves afford protection to both stem and head, the latter being large, compact, and of good quality. Sow late in April or early in May.

Fig. 58.—Broccoli—Michaelmas White.

Leamington (fig. 57).—One of the best of the late sorts, and being well protected by its leaves it winters well. It is largely grown for market. Sow late in April.

Michaelmas White (fig. 58).—Comes into use in autumn, has large white heads, firm in texture and of excellent quality. A popular sort.

Mitchinson's Penzance (Early White Cornish).—Leaves much undulated; heads large, compact, pure white. Is extensively grown in Cornwall for the London markets in April. Too tender for general cultivation.

Model.—Dwarf, compact, and hardy, with medium close conical head well protected by the leaves. Sow late in April for a supply in the following April and May.

Purple Cape.—Height 1 foot to 18 inches. Leaves nearly entire, waved; veins and midrib stained with purple. Heads middle-sized, compact, purplish-green, the whole becoming green when boiled. Sow first and third week in May for use in September and October. A longer succession—namely, till January—may be obtained, if required, from a sowing in the second week in June.

Purple Sprouting (Asparagus Broccoli) (fig. 59).—A strong-growing hardy sort, from 2 to 3 feet high; leaves spreading, much indented, of a purplish-green; head deep-purple; smaller sprouts from the axils of the upper leaves. If sown in April it produces heads or sprouts fit for use in November. After the first head is cut out, a succession of sprouts is produced through

the winter. The principal sowing is, however, made in the first or second week of May ; but if the ground intended to be planted is not likely to be cleared of the previous crop in time to receive the Broccoli plants sown in the beginning of May, before they get too old in the bed, the sowing must be deferred till the end of May or beginning of June ; and from these late sowings, heads or sprouts will come in for use in April.

SNOW'S WHITE WINTER.—Dwarf habit ; leaves broad, with short petioles. Heads large, very compact, well protected with leaves, white, and equal in quality to those of the Cauliflower. Sown first week in May and middle of June, the produce will be fit for use in December, January, and March.

SUTTON'S BOUQUET.—The central head is surrounded by several smaller heads, varying from five to twelve in number. A very late Broccoli, perfectly hardy, having escaped injury during most inclement winters.

SUTTON'S LATE QUEEN.—Quite distinct, dwarf and compact in growth, rarely affected by frost, and produces splendid heads in May and June. Has resisted the intense cold of the most severe winters. The heads are well protected, large, handsome, and excellent in quality.

VEITCH'S AUTUMN PROTECTING.—A valuable early variety. Produces firm close compact white heads, of delicious flavour. The protective covering of leaves is very pronounced. Sow under glass in March and in the open ground in April.

WALCHEREN. See *Cauliflower*.

Fig. 59.—Purple Sprouting Broccoli.

WHITSUNTIDE (Suttno's) (fig. 60).—Similar to Latest of All, but larger, and even later. It has borne 22° of frost without injury. Heads snow-white, compact, protected by the twisted leaves. Sow in June.

WILLCOVE.—Late, dwarf, and comparatively hardy, affording a supply till Cauliflowers come in. It derives its name from a small village near

Fig. 60.—Broccoli—Whitsuntide.

Devonport, noted for the production of late Broccoli, and where this variety is grown in great perfection.

WINTER MAMMOTH.—Comes into use in mid-winter. Vigorous in habit and self-protecting. One of the best to follow Michaelmas White.

BRUSSELS SPROUTS (*Brassica oleracea gemmifera*).—This vegetable was long cultivated near Brussels, the place from which it derives its name, before it was introduced into Great Britain. It was supposed that genuine seeds could only be obtained from Brussels ; now, however, the best strains are of British origin.

Dr. Van Mons, of Louvain, says : "We have no information as to the origin of this vegetable ; but it has been a very old inhabitant of our gardens, for it is mentioned in the year 1213 in our regulations for holding the market, under the name of *spruyten* (sprouts), which it bears to this day."

Formerly Brussels Sprouts were supposed to be too tender for our winters. They prove, however, to be as hardy as the Savoy, and almost as hardy as Borecole, and they are possessed of much greater excellence than either. When well grown, the amount of their edible produce is more than equal to that of Borecole. Brussels Sprouts may be cultivated on any soil, the best being a good heavy loam. Thorough preparation of the ground is important. An open situation should be selected, and the soil be well trenched, in-

corporating at the same time a supply of well-decayed manure, especially in poor soils, less manure being needed when the soil is good and fertile. The digging should be done in autumn, and the surface may be left in a rough state, as the action of the weather will bring it into a workable condition.

Sowing.—The first sowing should be made about the first week of March in gentle heat, afterwards for the principal crop a sowing should be made about the 18th March and again in the second week of April. Plants raised in heat should be pricked out in boxes about 3 inches apart each way, and afterwards transferred to a warm border of the garden before the final planting, which should be done when the plants are about 6 or 8 inches high.

In Scotland, and in cold situations in England, sow in August, and transplant the seedlings in spring. For succession sow again in March, and a small sowing again in April. From late-sown plants less produce is obtained than from those sown early, but the quality is better.

Planting.—Brussels Sprouts deserve a liberal allowance of ground, especially for the early planting. Later, to economize space, rows may be planted between the alternative rows of early potatoes or between Peas and other crops that are cleared off early, allowing 2½ feet between the plants.

In the open, plants should be set 3 feet between the rows and 2½ feet in the rows, as plants have been known to cover a space of 4 feet square. Use a trowel for planting, securing a good ball of soil on the roots; plant firmly and water in; if they are likely to suffer from want of moisture the ground should be well hoed and the plants occasionally given a soaking at intervals of liquid farmyard manure or soot water, which will greatly assist them during the growth. When the side-leaves are fading and beginning to fall, remove them, but on no account interfere with the tops. These, when fully grown, form a very tender mildly flavoured dish, but should yet be left where they are till late in the season, as they serve to nurse up and protect numerous close late sprouts—the latter always meeting with favour. Also cut the Sprouts so as to leave a short stump behind, rather than drag them off with a portion of the bark of the stem with them, as by the former method only is a good supply of late sprouts ensured. These are particularly acceptable after a hard winter. When they are wanted as late as possible lift the plants early in the spring, and replant rather more closely than formerly on a north border or other cool place. The tops should be removed whether wanted for use or not. Seeds to be saved from the best stocks only, and in the same careful manner as advised in the case of Borecole.

Fig. 61.—Brussels Sprouts.

Fig. 62.—A Basket of good Sprouts.

Insects, &c.—See under Cabbage.

AIGBURTH.—Very large sprouts, hardy and productive.

DWARF GEM.—The dwarfest of all Brussels

Sprouts, producing buttons in advance of other varieties. Of medium size, very solid, and delicious in flavour.

EXHIBITION.—A distinct and early variety; of vigorous growth, perfectly hardy, and very productive, the stems being covered from top to bottom with sprouts, which are firm, solid, remarkably tender, and of delicate flavour; remaining a long time fit for use.

HOLBORN EXHIBITION.—Medium height, with solid sprouts from base to crown; of good colour and productiveness.

PARAGON.—A very superior strain of dwarf growth and compact habit; bearing in abundance closely set, medium-sized solid sprouts, of fine quality and mellow flavour.

SCRYMGER'S GIANT.—A first-class sort, dwarf, with large firm sprouts, which remain a long time fit for use; very reliable.

SUTTON'S MATCHLESS.—Growth robust, stems covered with compact globular sprouts of excellent flavour. Very hardy, taller than Exhibition.

CABBAGE (*Brassica oleracea*).—The Wild Cabbage, from which all the garden races of Cabbage have sprung, is a native of sea-cliffs on the south-west of England and Wales and the Channel Islands. It is also wild on the west and south coasts of Europe. In its wild form it is a biennial or perennial, with a stem 1 to 2 feet high, stout, tortuous, usually decumbent and scarred, leafy at the top, the leaves wavy, glaucous, and succulent, 1 to 1½ foot long; flower stem tall, branched, bearing pale-yellow flowers an inch in diameter.

De Candolle states that the date of its cultivation is probably very ancient, earlier than the Aryan invasions, and that no doubt the wild plant was used as food long before it was cultivated.

"The principal kinds of Cabbage existed at least as early as the sixteenth century, so that numerous modifications of structure have been inherited for a long period. This fact is the more remarkable, as great care must be taken to prevent the crossing of the different kinds. I raised 233 seedlings from Cabbages of different kinds, which had purposely been planted near each other, and of the seedlings no less than 155 were plainly deteriorated and mongrelized; nor were the remaining 78 all perfectly true. It may be doubted whether many permanent varieties have been formed by intentional or accidental crosses, for such crossed plants are found to be very inconstant" (Darwin).

The Cabbage finds a place in every British garden, as it is one of the most useful of vegetables. It is grown on a large scale for the supply of the markets. For spring cutting it is particularly appreciated, as it comes in at the time when other green vegetables are generally scarce.

Site.—This should be sheltered from the north-east. A well-manured soil is essential for the production of tender and succulent Cabbages. The ground should be well trenched and a liberal supply of farmyard manure added, as the Cabbage is a gross feeder and is not so liable to club-root on good soil. Light soil should be fortified by adding when procurable a dressing of marl, gypsum, or burnt clay to make it retentive. Lime should be applied, especially on heavy soil, or where there is an excess of humus. Other artificial manures may be given occasionally; yet in this case they do not excel farmyard manure, which keeps the soil open.

Sowings.—The first sowing should be made about the end of February or beginning of March. It should consist of Earliest of All or other quick-growing varieties of medium size and good quality. From this sowing a supply will be obtained for use in July and August, and will thus form a succession to the autumn-sown crops.

A second sowing, which may be the principal spring one, should be made in the last week of March or first week in April, for a supply from August till November.

A third sowing, to consist chiefly of either Nonpareil, Tender and True, or Little Pixie, with London Rosette, or similar kinds that heart quickly, may be made early in May for the early part of winter.

The fourth, or autumn sowing as it is occasionally termed, is the most important, as it furnishes the plants which afford the principal supply for spring and early summer use. The proper time for this sowing varies

Fig. 63.—Cabbage—Ellam's Early.

from the middle of July to the middle of August, according to the soil, climate, and

variety employed ; a cold soil and climate requiring the earlier period. Early Battersea, Sutton's April, Harbinger, Flower of Spring, Sutton's Earliest, and Ellam's Early, not being apt to run to seed, may be sown earlier than Early York, and others similar to it, which often bolt.

In warm soils and situations the best time for sowing Ellam's Early Dwarf, Sutton's April, and other non-bolting sorts is about the 20th of July, a week earlier answering well in the colder counties, even if the subsoil is of a clayey nature. Many market-gardeners near London always sow at this time. Those sown in July will be ready to plant out early in September ; and those sown in August early in October, when ground can be cleared for their reception.

Red Cabbages may be sown in a frame

Fig. 64.—Cabbage—Sutton's Flower of Spring.

early in February to provide good solid heads for pickling by the autumn.

Sowing for Coleworts.—The cultivation of an open, hardy Dorsetshire Kale for winter Greens has long been discontinued. These Greens were known under the name of Coleworts. This name, or others evidently derived from it, as Collard and Collet, is now applied to young unhearted Cabbages, which are pulled up by the roots, and tied in bunches for the market. London Hardy Green and Rosette are two of the best varieties. A sowing should be made in May and June for a supply of plants for filling up vacant pieces of ground after other crops have been cleared.

Additional Sowings.—Sowings at the periods named will generally be sufficient for a supply throughout the year ; but in case of any deficiency in the autumn-sown crop, it will be advisable to sow some of the early kinds on a warm border, about the end of January or beginning of February ; or, preferably, in a frame, taking care, however, that the plants are kept thin, exposed as much as possible to the light, plenty of air being given at all times, and covering only when the severity of the weather renders it absolutely necessary.

Cultivation.—The soil in the seed-beds should be light and well pulverized. On a large scale the ground is raked tolerably smooth, the seeds sown in drills and raked in. In private gardens, where fewer plants are needed, the seeds can be sown in drills in a convenient position. When large enough the seedlings should be thinned, and the soil kept stirred with a small hoe. Thus treated the plants do not become crowded, and they form good roots without pricking out into nursery beds, as is sometimes done in order to encourage the production of more fibres. This object may also be effected by thoroughly watering the beds about a week before transplanting, and then raising a little both soil and plants with a fork. In consequence of this moving, fresh roots are made, and the plants suffer less when finally transplanted.

The distances at which different sorts require to be planted depend on the size which they usually attain and on the richness of the soil. The smallest sorts may be planted a foot apart each way ; but more room may be allowed in rich soil. Near London, the early varieties are planted 2 feet apart each way for a spring supply ; but then the rows are backed, as it is termed, with plants sown a week or ten days earlier. A plant is inserted between every two in the rows already planted, to be afterwards drawn as Coleworts ; and, for the same purpose, an intermediate row is planted a foot apart between the permanent rows. The ground is then occupied with plants at a foot apart each way, but all are removed for use as Coleworts in the course of the winter, except those planted at 2 feet apart for hearting in spring. If Coleworts are not to be grown intermediately, the distance between the plants is reduced to 22 inches each way.

Coleworts, when planted by themselves, may be about 12 inches apart, and every alternate plant in the row should be taken as required for use ; the additional space thus given will soon be occupied by the plants which are left.

In transplanting Cabbages advantage should be taken, if possible, of cloudy moist weather ; but in long-continued drought

the plants in the seed-beds may get so large as to render it absolutely necessary to move them out at all hazards. The surface of the ground for the intended plantation should be well pulverized, and drills similar to those made for Peas should be drawn for the rows, and well watered a day previous to planting. If there are dry clods and dust on the surface, the consequence is this—when the dibber is thrust in and withdrawn a portion of the dry clods and dust falls into the hole—a condition very unfavourable for the roots. The seed-beds should also be well soaked, in order that the plants may be moved with little injury to the roots, which should be raised with a fork, and exposed to the air as little as possible.

The drills in which the Cabbages have been planted should be kept only moist, and not what would be termed wet, till the plants have struck root, when, if the surface of the ground be kept stirred, watering will scarcely be required. Except in dry weather, furrows or drills for the plants are not necessary. Gardens which supply the best Cabbages for the London markets are planted on the level, and no mould is drawn to the stems, the best growers avoiding what are termed long-legged sorts; neither do they force their plants to become such by overcrowding in the seed-bed. They find it advantageous to stir the whole surface of the soil, and close to the stems of the plants. If planted on poor ground, liquid manure should be given freely in the spring, or nitrate of soda at the rate of 2 lbs. to the square rod, otherwise growth will be slow and the hearts of little value. By drawing the soil to the stems furrows will be formed, along which sewage and strong liquid manure generally may be freely distributed with marked benefit to the crops. If the plants are left on the ground to form a second crop they must be manured afresh.

Propagation by Cuttings.—Cabbages are best raised from seeds; nevertheless they may be advantageously propagated by cuttings in some cases—for instance, in warm climates, where it is difficult to save seeds; and in this country it might be adopted in order to preserve any particular variety true; for by cuttings we can always depend on perpetuating the identical sort, but by seed this is uncertain. Supposing that it were desirable to preserve some much-prized sort, seed may be saved, and cuttings struck as well. If plants from seeds come true, so much the better; but if they do not, having the plants from cuttings we are still in possession of the true variety, and of the means of again raising seeds from it. The mode of propagating by cuttings is very simple. The sprouts are taken off, and exposed to the air till their juices are so far exhausted as not to exude from the wounded ends, and thus tend to rot the cuttings. It is also advisable to dip the cut end in newly slaked lime, dry wood-ashes, or powdered charcoal. The cuttings may then be planted out, either in the open ground, or, better, in a frame, where they can be properly shaded, not from diffused light, but from the sun's rays, till roots are formed. They may then be fully exposed till fit for planting out.

To save Seeds.—The finest examples should be selected for this purpose, and the more of them there are the greater will be the chance of the sort being saved true. The plants may either be allowed to run to seed where they have grown, or they may be taken up early in spring, and planted up to the neck in some place where they can be protected from birds when the seeds are ripening. It must be borne in mind that all the members of the Cabbage family intercross freely, so that if two sorts are in flower at the same time and near each other, cross pollination is almost certain to occur.

Club-root (fig. 65).—Diseases are dealt with in a separate chapter, but as Club-root or Anbury is the bugbear of the majority of Cabbage-growers it is included here as an important factor in cultivation. It attacks the various kinds of Cabbage, Turnip, Radish, Wallflower, in fact most cultivated plants, including weeds, belonging to the order *Cruciferae*. The root is the part most frequently attacked, the presence of the parasite being indicated by the formation of numerous nodules, or wartlike outgrowths, or the entire root becomes swollen and clubbed, eventually rotting and emitting a very disagreeable smell. The disease also exists in the leaves, at least in the case of Cabbages, but no distinction occurs, as in the root.

"The disease is contracted, in the first instance, by spores present in the soil, which enter the living cells of the root of the plant. When once inside a living cell, the parasite does not form a mycelium as in the fungi, but a glairy mass of protoplasm, called a plasmodium, which slowly alters its form from time to time, and constitutes the vegetative condition of the parasite. After remaining in the vegetative state for some time, and producing the swellings in the root alluded to, the plasmodium undergoes certain changes, and eventually becomes

resolved into myriads of exceedingly minute round spores, which, on the decay of the root, are liberated in the soil. What takes place when the spores are set free, as to whether they germinate, form a plasmodium that exists as a saprophyte for some time, is not known; but it is known with certainty that if Cabbages, Turnips, or other allied plants are sown or planted in soil that has produced diseased plants the previous season, or even two or three years previously, such plants will become diseased.

Fig. 65.—Cabbage—Club-root or Anbury.

"*Preventive Means.*—From what has been stated it will be seen that it is simply courting disaster sowing or planting Cabbages, Turnips, &c., in diseased soil; on the other hand, repeated experiments have proved that the application of quicklime destroys the germs in the soil. Lime is an effective preventive of club-root, and by its constant use, at the rate of 75 bushels or so per acre each year, Cabbages have been grown at frequent intervals—almost yearly—upon the same soil! The use of artificial manure containing acids, phosphates, and sulphates favours the spread of the disease. It has been demonstrated that soil from an infected locality, carried by means of cart-wheels, tools, &c., is sufficient to start the disease in a new locality. Weeds, such as Shepherd's-purse, Charlock, Garlic-mustard, and other crucifers should not be allowed to grow in places where cultivated plants belonging to the same order are grown. Do not throw diseased plants on the rubbish-heap, but burn them. Dr. Halsted states that the plants are most susceptible to the disease during the first three weeks after germination, and that 35 bushels of lime per acre is sufficient to arrest the disease" (G. Massee, *Text-book of Plant Diseases*).

Enemies.—Blue Cabbage Flea, Cabbage Aphis, Cabbage Butterflies, Cabbage Moth, Cabbage Powdered-wing, Diamond-back Moth, Garden Pebble Moth, Slugs and Snails, Cabbage Fly, Cabbage Gall Weevil, Daddy Long-legs, Dart Moths, Millipedes, Potherd Moth, Wire-worms, Yellow Underwing Moth. See chapter on Insects, &c.

Selection of Varieties

All Heart (fig. 66).—Heads of medium size, conical, compact, with very few outer leaves.

Fig. 66.—Cabbage—All Heart.

An excellent variety for spring, summer, or autumn sowing.

Beaconsfield.—After the style of Ellam's, but later. A dwarf grower with a conical solid head. Sow seeds in August for a late spring crop.

Christmas Drumhead.—Heads large, flat, somewhat spreading. An excellent variety for spring sowing, and for market or large establishments. Not suitable for autumn sowing.

Cocoa-nut.—Head close, egg-shaped, sweet and mild in flavour. Should be sown in March and July and planted 15 inches apart.

Early Battersea.—One of the oldest and best. Said to have been cultivated in London 150 years ago. It is dwarf, with a conical head, does not crack, and is sweet and tender when cooked. It has received numerous names.

Early Offenham.—Much grown by market-gardeners. It forms medium, conical, firm hearts of excellent quality.

Early York.—An old, much-esteemed sort, generally grown as an early crop. It is dwarf, with oval head, and has dark-green leaves with comparatively thin ribs.

Ellam's Early Dwarf (fig. 63).—Heads of medium size, ovate, compact, of fine flavour. A first-rate variety for autumn sowing, but not so good for spring or early summer sowing.

First and Best.—Heads rather large, conical, very compact, of good flavour. May be had practically all the year round by making monthly sowings.

Flower of Spring (fig. 64).—Heads of medium size, ovate, compact, of a fine delicate flavour.

Excellent for spring, early summer, or autumn sowing.

Improved Nonpareil.—Heads of medium size, ovate, compact, with a small spread of outer leaves, very tender, and of good flavour. Good for summer, autumn, or spring use.

Little Gem.—Heads small, ovate, and very compact, of a delicate and tender flavour. Excellent for spring or early summer sowing. May be cooked and served whole.

Little Pixie (Tom Thumb).—A small compact-headed sort of excellent quality and very early. Much grown in small gardens.

Matchless.—An excellent small early variety of dwarf, compact habit, turns in quickly and hearts well, very delicate in flavour.

Mein's No. 1.—Heads large, conical, with rather spreading outer leaves, of good quality. A very reliable hardy variety for autumn sowing.

Selected Winningstadt.—Heads large, conical, sharply pointed, moderate spread of outer leaves. A first-rate variety for spring or early summer sowing, but not so useful for autumn sowing.

St John's Day.—Hearts medium size, roundish, compact, of delicate flavour, and useful for spring, summer, or autumn crops.

Sutton's April.—Heads medium sized and shapely. An excellent variety for autumn sowing, as it rarely bolts.

Sutton's Earliest.—Heads rather large, ovate, remarkably compact, of a very delicate flavour, and may be had nearly all the year round.

Sutton's Maincrop.—Hearts large, flattish, rather spreading, and of very good flavour. A first-rate summer and autumn Cabbage, but not recommended for autumn sowing.

Red Cabbage (*Brassica oleracea capitata rubra*).—Of this, which is principally used for pickling, there are several varieties, differing in the size of their heads and in the depth of colour. The principal are :—

Dwarf Blood Red.—Heads small, round, compact, and of a deep-red colour ; excellent for pickling. If sown in spring it is ready for use in the early autumn.

Red Drumhead.—Heads very large, flat, deep-red, moderately compact. An excellent market variety. Suitable for spring or autumn sowing.

Red Dutch.—Head large, round, or flattened ; the sort chiefly grown in market-gardens.

Capsicum.—Several species of Capsicum are cultivated for their seed-pods, and are popularly known as Chili-peppers. In a green state they are used in salads, in pickles, and for making Chili vinegar ; dried and ground, when ripe, they form Cayenne pepper. The frequent adulteration of this condiment with red-lead and other poisonous substances renders the cultivation of the Capsicum in gardens for a home-grown supply very desirable.

Seeds should be sown in February or early in March, in pots or pans filled with light rich mould and plunged in a hot-bed. When the young plants are about 2 inches high they may be transplanted singly into 3-inch pots, from which they must be shifted on until in 6- or 8-inch pots, and in these they may be allowed to fruit. The plants should be kept near the glass in a warm vinery, pit, or stove, and water ought to be frequently given. In warm situations in the south of England fruit may be ripened in the open air. With this view plants should be hardened off towards the end of May, and planted out in June on a border with a south aspect, at 1 foot or 18 inches apart, watering at planting and subsequently in dry weather. In general, however, it is advisable to depend on plants under glass for a supply of ripe fruit ; but where the green pods are in request a considerable portion of the plants may, in warm situations, be turned out of doors. The fruit ripens in September, and may be kept two or three years in a dry room. The seed keeps best in the pods, and remains good for four or five years.

Varieties of Capsicum, mostly natives of the East :—

Bell Pepper (*C. grossum*).—An annual or biennial, with large variable-shaped fleshy fruits.

Bird Pepper (*C. baccatum*), *Piment enragé* of the French, a bushy perennial, with small, round, erect fruits.

Golden Dawn.—Large yellow fruit of mild flavour.

Guinea Pepper (*C. annuum*) (fig. 67), of which there are varieties producing red and yellow, long and short fruits.

Fig. 67.—Guinea Pepper.

Long Yellow Capsicum.—Differs from Spanish Mammoth chiefly in the colour of the pods, which is bright yellow.

PURPLE CAPSICUM.—A robust shrub 3 feet high, with pods 2 to 3 inches long, variable in shape, coloured purplish red when ripe. Very hot to the taste.

RED TOMATO CAPSICUM (American Bonnet, Bonny, or Bonnet Pepper) is like the preceding, but red; very productive, and much milder than the small sorts.

Fig. 68.—Spanish Mammoth Capsicum.

SHRUBBY CAPSICUM (*C. frutescens*), a bushy perennial, from which Cayenne Pepper is usually prepared.

SPANISH MAMMOTH CAPSICUM (fig. 68) has large pods much milder than the other kinds: excellent for salads.

TOMATO CAPSICUM (*C. dulce*), *Piment Tomate* of the French.—Fruit like a Tomato in size and form, yellow, and of comparatively mild flavour.

CARAWAY (*Carum Carui*) (fig. 69).—A biennial, native of Europe, including Britain, where it frequents waste places, growing 1 or 2 feet high, and producing heads of white flowers in July. It has fleshy parsley-like leaves and roots, and under cultivation behaves not unlike Parsley. The seeds are much used in confectionery, and for flavouring spirits and perfuming soap; it yields an oil, which is employed medicinally as a carminative. Considerable quantities are grown in Essex and Kent for these purposes.

Sow in drills 10 inches apart, in light warm soil, in autumn, when the seeds are ripe, or in March or April. When the plants are 2 or 3 inches high they should be thinned out to 8 inches apart; the ground must be kept free from weeds, and stirred by an occasional hoeing. The seeds will ripen in the following year, in July or August.

CARDOON (*Cynara Cardunculus*).—A perennial, native of Southern Europe. It is closely related to the Artichoke, and may have descended from the same species. It grows to a height of from 4 to 6 feet, and its large pinnatifid leaves are whitish beneath, and in some sorts armed on their margins with fine brown or yellow spines. The flower-heads resemble those of the Artichoke. The fleshy leaf-stalks are the edible part, as in the case of Celery. They are blanched, and, when properly cooked, constitute a tender and excellent vegetable, much esteemed, especially on the Continent. The flowers, like those of the Artichoke, have the property of curdling milk.

This plant prefers a light, warm, moderately rich soil, and an open situation. All the sorts are raised from seeds, either sown

Fig. 69.—Caraway (*Carum Carui*).

where the plants are to remain, or in pots under a frame for transplanting. A small quantity to come in early may be sown on a hot-bed about the end of March, but the main crop should not be sown till the middle of April; and where the climate is warm it is advisable to defer sowing till the end of

the month. A sowing for a late crop may be made about the end of June.

Trenches 1 foot deep, 18 inches wide, and not less than 4 feet apart from centre to centre should be prepared, and from 6 to 9 inches of well-decomposed dung should be dug in the bottoms; the seeds may then be sown in the centre of the trench, in patches of three or four, and covered with earth to the depth of about 1 inch. The distance between the patches may be 18 inches. When the plants are 2 or 3 inches high they should be thinned out, only the strongest plant in each patch being allowed to remain.

Cardoons are sometimes grown when the soil requires to be pulverized after a rest from heavy cropping. Having marked off the spaces for the trenches and ridges, allowing 6 feet for each, those spaces marked out for the ridges are manured well and dug, keeping in view the improving of the pieces of ground for other crops, as well as providing for the Cardoon. The trenches are next dug out 1 foot deep, laying the soil right and left on the ridges, and breaking the lumps well as the work proceeds. The sides of the ridges are beaten smooth with the back of a spade. A compost, consisting of equal portions of chopped turfy soil, good half-rotted manure, and road-drift or fine ashes, and, if to be had, burnt clay, is put in the bottom of the trench to a depth of 6 inches, and forked in so as to keep the compost merely covered, while the ground below is loosened to the depth of 1 foot. The trench is then left uncropped until the season for planting, by which time the ground is ready for them.

Two rows of dwarf Peas are sown upon the ridges, and a row of Spinach between; these will be off before the Cardoons require earthing up. In the first week in May the seeds are sown in thumb-pots and placed in heat. When the seedlings are about 2 inches high they are hardened off and planted out 20 inches apart.

Raising them in pots, instead of sowing them in the ground, is to prevent gaps in the rows, and to give the opportunity of having all the plants in the ridge of equal size, so that when earthed up, the plants being alike in strength, the same quantity of soil will be required for all. The weakest plants may be kept in the cold frame ten days longer, which, with a second sowing, will give a succession. Water the newly-turned-out plants, and loosen up the soil between them, which finishes the planting part of the business. In dry weather the plants will require watering once or twice until they get established, after which they will only require to be kept clear of weeds by forking among them occasionally.

In the beginning of August the most forward row of plants will be ready for earthing up. Take advantage of a fine dry day, and commence by carefully bringing all the leaves into an upright position, cleaning away all broken leaves and suckers. A few ties of soft twine around the plants will assist in keeping them in position. Afterwards bands of brown paper 15 to 18 inches wide and long enough to pass round two or three times should be fixed and secured with raffia. Then closely wind around hay-bands to the top of the paper, which should be just below the centre growth of the plants, repeating every ten days or so until the required length is obtained. Exercise care in earthing up, so as not to allow any soil to get to the heart of the plant. In exposed positions the plants need to be staked to keep them in position. Previous to earthing up the trenches should receive a liberal supply of manure water.

Cardoons are fit for use in about five weeks after tying up. At the approach of severe frost it is advisable to protect the plants with litter. In France, before severe frost sets in, the plants, having been tied up for about a fortnight, are taken up with balls on a dry day, and replanted close together in a cellar, where the process of blanching is completed. Thus treated they are said to remain good till March. Or they may be kept in a trench 4 feet wide and 3 feet deep in a piece of dry ground, the sides lined with a good thickness of straw, against which one or two rows of Cardoons are placed, the extremities of the leaves being left above-ground, then another layer of straw, and another row of plants, till the trench is filled. The plants are sheltered from rain, and protected from frost by long litter, which is always removed in mild weather.

Cooking.—After the Cardoons have been trimmed and washed, and their outside leaves removed, they are cut into pieces 4 inches long, placed into a pan of cold water and boiled until the outer skin can be easily removed with a cloth. After this they are well washed, and again boiled in good stock or broth. They are served very hot with brown sauce made with good gravy. It is an improvement in serving Cardoons to put some Marrow round them.

The common Cardoon has spineless

leaves, leaf-stalks solid, but not so thick nor so tender when cooked as those of the other varieties ; it is also apt to run to seed. The Spanish Cardoon has spineless leaves with large nearly solid ribs. Like the preceding, it is apt to run to seed. The leaves of the Tours Cardoon (fig. 70) are excessively

Fig. 70.—Tours Cardoon.

spiny, so much so that care is requisite in working among the plants. Notwithstanding this drawback, the variety is much cultivated in France on account of its large, thick, solid, tender ribs. The plants are not so liable to run to seed as those of other varieties. The red-stemmed Cardoon is an excellent variety recently obtained from Marseilles. Leaves nearly smooth, ribs tinged with red, very large and solid, not apt to run to seed ; but scarcely so hardy as the Tours Cardoon. The Puvis Cardoon is remarkable for its strong growth, the large size it attains, and the thickness of its ribs, which are almost solid. The leaves are thick, not prickly, or only very slightly so. It is a fine variety, of more tender substance than the Cardoon de Tours.

CARROT (*Daucus Carota*).—A hardy biennial, native of Asia, Africa, and Europe, including Britain, where it is found wild very commonly by roadsides and on dry banks, especially near the sea.

The roots of the wild Carrot are small, hard, and frequently much forked ; but that it is the parent of our cultivated varieties has been proved by M. Vilmorin, who succeeded in obtaining, in three generations from seeds, roots of considerable size. Some of the roots so obtained were as large as garden Carrots of the largest size, and their appearance was exactly the same ; the flesh, however, was more compact and the flavour milder. Persons who tasted them considered them superior to the old varieties.

The varieties grown in Britain are chiefly scarlet, although on the Continent white, purple, and lemon coloured varieties are in use. Carrots form one of the most important kitchen-garden crops, as they are available for daily use throughout the year.

Soil.—A sandy alluvial soil, properly drained, will suit Carrots, and heavy crops have been obtained on good loamy soil, providing it is of an open porous nature to permit the tap-root to descend perpendicularly, which it will sometimes do to the depth of 3, 4, or even 5 feet under very favourable conditions. Cold, stiff clay soils and others that are too compact may be improved by adding plenty of old soil from the potting bench, wood ashes, or decayed leaf-soil and any sand procurable. Frequently none of the soil of a garden is of the best description for the cultivation of Carrots. In shallow soils the Short Horn varieties are most reliable, and where there is a good depth of soil the intermediate sorts answer well.

Manures.—Lime, potash, soda, and chloride of sodium may be applied with advantage as manures. Farmyard manure laid on the surface and dug in is apt to make the roots fork. The best way of applying it is to trench the ground, and, in so doing, to let the manure be placed not nearer the surface than 18 inches. In this way even fresh stable manure may be applied. Carrots are, however, generally sown without manure in soil that has been well manured for the preceding crop.

Preparation of the Ground.—The ground, if not trenched, should be double dug and thoroughly worked, so that it may be of uniform consistence, and not richer at the surface than lower down. The tap-root will then strike down quite perpendicularly, but if the soil is rich near the top, and hard or poor below, the root will probably fork. It is best to trench or ridge up the ground during the winter, taking the opportunity of dry weather in spring to break down the ridges so as to bring the soil into a good tilth. This is done by forking it over to a depth of about 5 or 6 inches on a fine day. After this the surface is raked over.

Extra fine carrots are grown by boring

holes to a depth of 3 feet with an iron bar, and filling them with soil which has been passed through a quarter-inch-mesh sieve. A few seeds are then sown on each of the little patches of fresh soil which should be 16 by 14 inches apart. When the plants come up, the best one should be allowed to remain as near the centre of the patch as possible. General thinning should take place at intervals, leaving three plants at the first thinning.

Sowings.—Near Paris the first sowing of Early Horn is made in September, in the open ground, covering with litter in frosty weather; and from this sowing Carrots are

Fig. 71.—Carrot—Early Short Horn.

obtained fit for use in May. There is no reason why this plan should not prove successful in this country, for the frosts are generally more severe in winter near Paris than near London. A small quantity of Early Horn should be sown on a warm border in January, or in the first week of February. Another sowing of the same sort, together with some of intermediate varieties, may be made in the last week of that month, or in the first week of March. The main crop of intermediate and other large sorts for winter use should be sown between the middle of March and the middle of April. If the weather and state of the ground be favourable, the earlier period will be proper in the northern parts of the kingdom. In warm soils, in the southern part, the middle of April will be early enough for the main crop. Small successional sowings of the Horn kinds may be made in June and July; and, finally, in the first or second week in August a sowing of Early Horn for spring use may be made in a situation where some protection can be conveniently given during severe weather.

For Early Horn and similar small sorts the drills should be 12 inches apart, and the plants thinned to 6 inches apart in the rows. Intermediate varieties may be 14 inches from row to row, and the plants 8 inches apart in the rows. In soil where the Carrot attains a large size, more space should be allowed than where smaller roots and tops are produced. In general, 14 inches between the rows, and 8 inches from plant to plant in the row, will be about a proper average distance. On strong soils, where the roots become objectionably coarse if given much room, they may be left thicker in the rows. The edges of the drills may be smoothed down with the back of a hay-rake, or a little fine light soil may be put over the seeds. Care should be taken to insert a small stick or two at each end of the rows, so that the intervals can be hoed if weeds start up before the Carrots themselves appear.

As soon as the plants can be handled, they should be thinned at first to half the distance at which they are to remain for full growth: the intermediate ones will serve for drawing young. After thinning, weeding and hoeing must be continued; but the surface should not be deeply loosened, as this encourages forking.

In cold soils, and in sunless weather, the seeds lie long in the ground without germinating, and under such circumstances they would be as well in the seed-room, but the first opportunity should be taken to sow when the weather is favourable. It is not advisable to sow when the soil is wet and cold. A good tilth and even surface are essential for the cultivation of Carrots. After sowing apply a dusting of wood ashes and soot.

The seeds of the Carrot are apt to lose their germinative powers; it is therefore advisable to test them before sowing by placing a few in a flower-pot in gentle heat; when they come up the proportion of good and bad seed in the lot can be ascertained.

Taking the Crop.—Carrots are drawn young as required. The main crop is taken up at the middle of October, a dry day being chosen for the operation. This is performed by loosening the root with a fork, pulling by the top at the same time; the top should be removed close to the crown.

The roots should be stored in sand scarcely moist, but by no means over dry. The situation in which they are stored cannot be too cool, provided the roots are safe from frost. An underground cellar is not the best place, an open shed being

better, or a loft with an open shed below, covering them with as much sand as will prevent them from being affected by sudden changes of temperature. To store a large quantity in an open shed, select the longest roots for the lowest layer ; lay them shoulder to shoulder, with their crowns towards the wall, but close to it ; then place another layer in the same way, but with their crowns opposite to those first laid. Proceed thus with other layers, selecting always the next longest roots to those which formed the preceding layer, and consequently finishing with the shortest roots. The whole should then be covered with well-dried straw or fern. They may also be thus arranged in the open ground, if it be dry, and then covered over with thin dry turf, leaving some openings stuffed with straw, to afford ventilation.

Whatever mode of storing is adopted, no great bulk of roots should be put together, otherwise fermentation may take place, and the flavour of the Carrots consequently spoilt. In soils where maggots do not attack the roots, they may be left in the ground till towards spring, care being taken to cover them with litter in case of frost. Late-sown breadths may be left in the ground, and tender young roots drawn as required. In order to be able to do this in frosty weather protect with a good thickness of strawy litter.

To save Seeds.—This may be done either by leaving some plants in the ground, and protecting them from frost ; or, in taking up the crop, some of the finest specimens may be selected, their tops cut off at some distance from the crown, and preserved in sand till February or March, when they should be planted out about 18 inches apart in good soil enriched with decomposed manure. As the umbels successively ripen their seeds they should be cut off, and laid on a seed-cloth in the sun, to get thoroughly dry for rubbing out. Some recommend hanging up the stalks and rubbing out the seeds when they are wanted for sowing. Seeds more than one year old cannot be depended upon.

Forcing.—The best sorts for forcing are Sutton's Early Gem and Early Short Horn ; they may be sown on a hot-bed in the end of November or beginning of December ; again in the middle of January ; and again early in February, if the weather be severe ; otherwise this sowing may be made on a warm border. A hot-bed 3 or 4 feet thick of leaves, or of 15 or 18 inches of dung, should be prepared, and covered with 14 inches of sandy soil and leaf-mould, so that the surface may be within about 6 inches of the glass. The seed may then be sown in shallow drills, 8 inches apart, and covered with fine mould to the depth of ½ inch. When the plants come up they should be thinned to 2 inches apart in the row. The temperature may be from 60° to 65°, and the sashes must be covered at night and in frosty weather ; but as much light and air as possible should be given. Cold draughts should be avoided ; and if the soil should get too dry, a gentle watering may be given. Radishes are frequently sown along with Carrots, the rows alternating, and the Radishes will be ready for use before the

Fig. 72.—Carrot—James's Intermediate.

Carrots require all the space. Carrots may also be forwarded considerably in rough or unglazed frames, and on raised beds with only stakes and mats for coverings. In each and every case a very mild hot-bed only is desirable.

Enemies.—Carrot Blossom Moth. *Fruit and Seed Enemies*.—Carrot-seed Moth. *Leaf Enemies*.—Carrot Aphis, Common Flat-body Moth. *Root Enemies*.—Carrot Fly, Daddy Long-legs, Millipedes, Wireworms, Yellow Underwing Moth. See chapter on Insects, &c.

The principal varieties of Carrots are :—

ALTRINCHAM.—Leaves long ; root large, tapering slightly, but ending rather abruptly in a small tap-root ; the surface is rather uneven and

wrinkled. Flesh bright reddish-orange. One of the very best sorts for garden culture; a favourite in the Paris market.

EARLY NANTES.—Root cylindrical, with a blunt point, even and clean; red, sweet, and tender, coreless. One of the earliest and best. Prefers a mellow deep soil and moisture.

EARLY SHORT HORN (French Horn) (fig. 71).—Leaves few and dwarf; root short, globular or top-shaped; orange-red, reddish-yellow when young. One of the earliest and best for forcing.

GUÉRANDE.—Root 4 to 6 inches long, very blunt at the apex, grows quickly and to a good size. Flesh orange-red, yellow inside, tender, and sweet. Succeeds best in a light soil.

JAMES'S INTERMEDIATE (fig. 72).—One of the best; a favourite in England. Root thick, tapering, orange-red; very vigorous and productive.

LONG RED (Long Surrey).—Leaves of moderate length; roots long, tapering regularly to their extremity. Flesh reddish, heart yellow. This

Fig. 73.—Carrot—Early Gem.

and the Altrincham are the best two for the general crop.

NEW RED INTERMEDIATE.—One of the most pleasing sorts of the intermediate type. Skin clear and of good colour, flesh close, with very small core.

PARISIAN FORCING.—Leaves few and short, roots small and almost spherical, tender and sweet, an excellent forcer.

SUMMER FAVOURITE.—Half-long. Flesh bright cochineal scarlet; generally cultivated for summer use.

SUTTON'S EARLY GEM (fig. 73).—Roots about 5 inches long and 3 inches in diameter; almost coreless, of first-rate quality. A very reliable early variety.

WHITE BELGIAN.—The largest known; succeeds in soils too strong for the finer varieties. It is better adapted for the field than the garden. The leaves are strong and tall; roots very thick, a considerable portion rising above the surface of the ground, acquiring a greenish tinge when exposed to the light. It cooks tender, but its colour is not pleasing.

CAULIFLOWER (*Brassica oleracea*, var. *Botrytis*).—A variety of the Cabbage in which the inflorescence is pushed up early and arrested in its development, the flower-stalks thickening whilst the true flowers are changed into mere points, the whole forming a dense compact succulent head. It differs from the Broccoli only in being more tender and less coarse in growth, and in its being cultivated for summer use. Nothing appears to be known of its origin. Miller says it was introduced into England and the continent of Europe from Cyprus, and that probably it had been brought to the latter place from some other country. It appears to have been cultivated for ages in the island of Cyprus and on the coasts of the Mediterranean. Unprotected, it would rarely withstand the severity of our winters.

Soil.—A rich, highly manured soil, such as that recommended for Broccoli, will suit the Cauliflower. It should in all cases be well drained, but a soil that is too dry is not well suited for the summer crop, as it induces the plants to "button," that is, to form a very small heart. The manures recommended for Broccoli are equally suitable for the Cauliflower.

Autumn Sowing.—The time for this is about the 13th of September, and it is advisable to make another about seven days later. Varieties most suitable are Walcheren, an excellent variety, and especially valuable in hot, dry summers, when scarcely a head of the ordinary sort could be obtained.

Magnum Bonum is also a first-rate variety of excellent quality, which is fit for use a few days earlier than Walcheren. The seed-bed should be in an open situation, well exposed to light, and the soil of a medium quality and friable. Sow the seed in drills 6 inches apart, covering over with fine soil, watering in and protecting same from birds, as otherwise the crop may be lost. As soon as the plants are of sufficient size they should be pricked out 4 inches apart in cold frames, using poor soil, as the plants must not be encouraged to make much growth during the winter. From the first they should be exposed to as much light and air as possible. Except in case of heavy rain, they may be left uncovered till frosts occur, when the sashes should be put on at night. When frost continues night and day the sashes must be kept close and covered with mats or straw; before planting out the sashes should be dispensed with, in order that the plants may be hardened off. If any plant is affected with mould or mildew it had better be removed; some flowers of sulphur may be scattered in the frame by means of a sulphurator. Slugs and other enemies should be carefully looked after, and to prevent their attacks ashes should be strewed along the sides of the frame. If only a few dozen plants are wanted, these

may be wintered singly in 4-inch pots, either in a cold pit or frame, or else on shelves in a house heated only to keep out severe frosts.

In the end of February, or as soon as the weather proves favourable, some of the plants should be taken up with good balls or moved out of pots, and planted out in rich well-manured ground, in patches of three or four, so that they may be covered with a hand-glass. Air should be given more or less freely according to the state of the weather. When the plants get too high for the hand-glasses, the latter should be raised by placing bricks beneath the corners, or, better, by putting another hand-glass on the top of the first. The top of the hand-glass will require to be removed when the plants become large, and ultimately the whole of it.

Cauliflowers wintered in frames may, however, be obtained earlier by the following mode, which is practised near Paris. The cold there in February is generally greater than it is at the same period in this country; we may therefore properly adopt the plan, even in cold situations. In the beginning of February a trench, about 18 inches deep, is filled with equal parts of dung and leaves, in alternate layers, to the height of 15 inches, in order to produce a slight bottom-heat. The dung and leaves are covered to the depth of 9 or 10 inches with a mixture of one-half decayed dung and one-half soil. Ten or twelve days after this is done the Cauliflowers are planted, 20 inches apart, and covered with *cloches* or bell-glasses. Under each of these four Cabbage-Lettuces are also planted. Some dry litter is placed between the glasses, and in severe frost they are covered with straw-mats. In this way Cauliflowers are obtained fit for use in April.

Instead of wintering them in frames, Cauliflowers are often planted out in the end of October or beginning of November, in patches 3 feet apart each way, and protected through the winter by hand-glasses. Six plants or more may be sheltered under each hand-glass during the winter; but all except four or five, according to the size of the hand-glass, should be removed in spring when the weather will permit.

Fig. 74.—Cauliflower Plants in Frames.

Sometimes Cauliflowers are placed in front of a wall in the following manner: A trench is taken out a foot wide, and not so deep as in any way to interfere with the roots of the trees. In this about 6 inches of stable-manure is placed, and covered over with rich soil. The plants are then put in at 6 inches apart. In spring only every third plant in the row is left, those removed being planted elsewhere. After the Cauliflowers are cut, the dung put in the bottom of the small trenches should be turned out and incorporated with the soil of the border, otherwise the roots of the trees might be induced to run in it, and be liable to be destroyed by future diggings.

Near London the autumn-sown Cauliflowers are pricked out 4 inches apart, in beds in the open ground, and protected by means of hoops and mats. In this way they are generally protected sufficiently from frost and rain; but in continued severe weather the plants are apt to suffer from the want of light, and are then liable to damp off. The labour required for covering and uncovering is considerable, and mats are not only expensive, but are soon worn out; glass is a cheaper covering in the end, as well as being best for the healthy growth of the plants.

Fig. 75.—Hot-bed with Frames, for forcing Vegetables in Winter.

Winter and early Spring Sowing.—In order to obtain plants to form a succession to the crop produced by the autumn-sown plants, it is necessary to sow early in the season. The seeds are sown on a moderate hot-bed, and the plants reared under glass. They are not made to grow rapidly; a slow, regular, substantial growth is the aim. If the weather be unusually mild for the season the plants are allowed as much air and light as possible; they are then better able to resist the effects of continued severe weather which may subsequently occur.

The seeds are sown about the middle of January, on a moderate hot-bed. When fit, the plants are pricked out as directed for the autumn sowing; they may occupy the frames in which Lettuce plants have been wintered. They are planted out, some in the end of April and some in May; Magnum Bonum, Forerunner, and White Queen, 2 feet apart each way.

Besides the sowing in the middle of February for a principal succession crop, a small sowing may be made in heat in the first week in January, in case of clubbing or other accident to the autumn-sown plants; and another small sowing, also in gentle heat, may be made in the beginning of March.

Late Spring Sowing.—In the first week in April a sowing should be made in the open border. The plants may be pricked out, when fit, to 4 inches apart by 4 inches, or they may be allowed to remain in the seed-bed till required to be planted out in June. This sowing should include Early Giant, as it is not so liable to form buttoned heads as the other kinds.

Autumn Mammoth and Autumn Giant ought to be the most extensively grown. If good batches of these invaluable varieties were raised in February under glass and again early in April in the open, they would carry on the supply till Broccoli are ready. If extra fine heads of Cauliflowers

are desired, give occasional thorough soakings of liquid manure, more especially when heading commences. The heads may be cut when they are 4 inches in diameter, and

Fig. 76.—Cauliflower—Autumn Mammoth.

from that till they attain their full size, but before they lose their compactness. They should be carefully examined occasionally for caterpillars and slugs, also the flower should be protected from the sunlight, which spoils their whiteness, by tying up the leaves at the top with raffia when the heads are about the size of a tennis-ball.

Preservation from Frost.—When the head of a Cauliflower has once commenced to form, it will increase in size in the dark and without the assistance of the roots if kept in a mild temperature. It draws substances for its formation out of the succulent stem; the heads may therefore be preserved for use for a considerable time by any means that will secure them from frost and damp. A fairly steady temperature, between 40° and 45°, will keep growth active; a gentle circulation of air will be sufficient. Some recommend suspending the plants head downwards in a place free from damp; others take up and replant in dry sandy soil in an open shed: this is a more natural plan than suspending. By these and similar means Cauliflowers may be preserved in a fit state, so far as appearance goes and even very good as regards flavour if no decayed leaves are allowed to remain.

Forcing.—Since the introduction of extra late Broccoli, which carry on the supply till quite late in May, there has been far less need for forcing Cauliflowers. As a rule the latter can be had, with the aid of hand-lights, quite as early as wanted, but there are seasons when Broccoli are destroyed wholesale by a severe frost. It may then be very desirable to forward Cauliflowers as much as possible. They will not stand hard forcing. Reference has already been made to a plan of forwarding adopted by the French, and a modification of this practice might well be tried in this country, rough frames and glazed lights being substituted for bell-glasses. For frame-culture and for gentle forcing Sutton's First Crop is one of the best. If a stock of plants has not been raised in the autumn and wintered under glass, sow seed in gentle heat early in January. Thin out the plants early, and raise the pans or boxes well up to the glass, with a view to keeping them sturdy. Prior to pricking out in boxes, or placing singly in 2½-inch pots, the latter preferably, harden the stems by means of a week's change to a shelf in a cooler house, but return to a light position in gentle heat after pricking out or potting. Before the plants become root-bound shift to where they are to attain their size.

Only a mild hot-bed is needed for them, and this should have a covering of from

Fig. 77.—Cauliflower—Sutton's First Crop.

6 inches to 8 inches of moderately rich, loamy soil. Arrange the plants 15 inches apart each way, and plant rather firmly. They must be kept only moderately warm, the top heat, without air, seldom exceeding 55°, airing them freely on mild days, and drawing off the lights completely on very warm days. The plants must never become dry at the roots, and liquid manure should be given freely directly hearting commences.

Very large heads will not be grown in this way, nor are they particularly desirable, good cooks preferring a neat close head about the size of a cricket-ball.

Cauliflowers can also be grown successfully in 9-inch pots. Use rich, loamy soil, pot firmly, keep the plants near the glass in a warm pit, attend well to the watering, and use liquid manure freely from the time the roots have taken full possession of the soil. With the aid of heated pits and rough frames on mild hot-beds, glazed or only protected with mats, a succession of very good Cauliflowers can be had from April to the end of June.

To save Seeds.—Seeds are best obtained from autumn-sown plants which have been wintered in a frame, and well supplied with water during the whole period of their growth. The selection should be made, and the plants marked, when the heads are in perfection. Plants having short thick stems, with firm heads of a fine white colour, should be preferred. Any that exhibit a disposition to form heads before the generality should be watched, and if with this disposition they do not quickly break the curd to run to seed, there is a chance that seeds saved from them will be the best for early produce.

Diseases and Insects.—See under CABBAGES.

AUTUMN MAMMOTH (fig. 76).—Heads large and solid. Does best when sown in spring for planting outside. A favourite for exhibition purposes.

CARTER'S FORERUNNER.—An excellent early, dwarf and compact in growth, with pure white heads of first-rate quality.

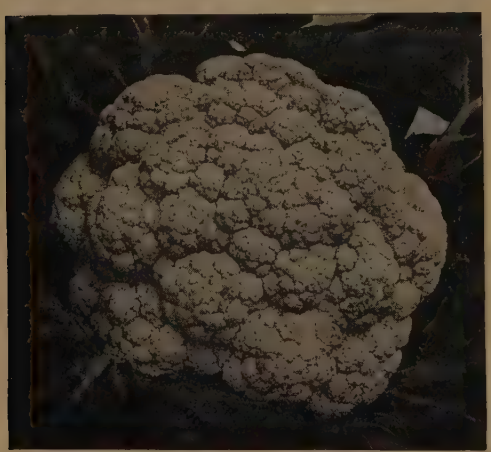

Fig. 78.—Cauliflower—Early Autumn Giant.

DEAN'S EARLY SNOWBALL.—Of the Erfurt type, but dwarfer and earlier, maturing quickly, being ready to cut in four months from the time of sowing. Stem very short; leaves short, narrow, pointed, of a silvery-green; head white and very close.

DWARF ERFURT.—One of the earliest; grows about a foot high; leaves short; head compact, large, white, if protected from light. One of the best for forcing.

Fig. 79.—Cauliflower—Purity.

EARLY AUTUMN GIANT (fig. 78), earlier than Autumn Giant, produces heads of good size of fine close texture.

EARLY FORCING.—An extra variety, suitable for autumn sowing and afterwards for growing in frames and pots.

EARLY LONDON (Early Dutch).—A large, hardy, rather tall Cauliflower, with a fine white, compact head. Largely cultivated near London for an early crop; also in Holland, France, &c. for the English market.

MAGNUM BONUM.—Sowing of this excellent variety should be made in September and afterwards early in the year. Quality and colour excellent.

PURITY (fig. 79).—Heads large, of the Magnum Bonum type. Should be sown in January in heat and again in September. The heads remain in prime condition a long time.

SUTTON'S FIRST CROP (fig. 77).—A small compact-headed variety, one of the best for forcing and as an early one in the open. Succeeds best from a September sowing for planting outside in spring.

VEITCH'S AUTUMN GIANT.—A valuable and distinct variety. Head large, firm, compact, white, well protected by the foliage. Sown in April or May, it forms a capital succession to the Early Autumn Giant; plants from a sowing made the second week in April yield firm solid heads by the first week in September. May also be sown in the autumn and the plants protected in cold weather to afford hearts in the following August.

WALCHEREN (Walcheren Broccoli).—An excellent sort, originally introduced from Haarlem under the name of Early Leyden. The stem is rather dwarf; leaves broad, less pointed, and more undulated than usual. It resists cold in winter and drought in summer better than any other Cauliflower.

CELERY (*Apium graveolens*).—A hardy biennial, a native of Europe, &c., including Britain, where it is found wild by ditches and in marshy situations. It appears to have been cultivated by the ancients. Except the forms cultivated for their fleshy roots (*Celeriac*), which are eaten when cooked, the variations from the wild plant are only in the length and consistency of the leaf-stalk. The quality of any particular variety is much influenced by that of the soil in which it is grown.

Soil.—A light, rich and rather moist loamy soil is best adapted for the growth of Celery. Although the plant requires plenty of water, yet it is apt to rot in winter in cold wet soils. Provided manure is at command, a poor light soil is better than one that is stiff and rich; for the growth can be made to depend chiefly on the manure supplied, and the plant grows better when its leaf-stalks are surrounded with light porous soil than when it is pressed against by that which is heavy and compact. The latter is mechanically injurious; for though the expansive power of vegetation in its natural state is very great, yet the blanched heart of a Celery plant, not being in its natural state, cannot force its way against such heavy obstructions as it would do when in possession of its full vital energy; and when too much loaded or pressed by soil of a heavy nature, it must rot. Light sandy loam, well manured with cow-dung, produces good Celery, provided plenty of moisture be afforded. Good peat soil, limed and manured, will also produce Celery of superior quality. Celery is one of the most important kitchen-garden crops, and no crop does so much to improve the land and bring it into good condition. The trenches may be made as soon as the autumn crops are cleared, and may be utilized for peas or beans the following year, while the spaces between may be planted with French Beans or Lettuces.

Sowing.—For the early crops the seeds should be sown in heat about the second week in February, and from this sowing the crop should be ready for use in August and September. For a later supply the seeds may be sown about a month later. The compost should be of a fairly rich nature, and the seed sown thinly in pans or shallow boxes. As soon as the seedlings are large enough to handle they should be pricked into boxes and placed in moderate heat, keeping them as sturdy as possible. They must not receive any check or forcing whatever, and be carefully protected from frosts. Any vinery, Peach-house, or frame where the temperature is from 50° to 55° will be suitable for them. This temperature is about that of the open

Fig. 80.—Celery—Wright's Giant Grove.

air in May, so that when the plants are then finally planted out they will receive no check, the temperature to which they are exposed being not lower than that to which they had previously been accustomed. These remarks apply also to other sowings made in heat.

The first sowing for autumn use should be made in gentle heat under glass in the first week of March. The seedling from this sowing may be considered to be for the main crop. The young plants may be pricked into skeleton frames in a mixture of leaf-mould, rotten dung, and a little friable loam 4 inches deep and made moderately firm. When the plants are about 6 inches high they may be transferred to their permanent quarters. As planting proceeds the plants should be well watered in and successional plantings should be made as the ground becomes vacant. A few trenches may be got out between early Peas and plots that have been cropped with Spinach and Cabbages.

A second sowing should be made in the end of March, either in a frame or under hand-glasses. Bottom-heat may be dispensed with; but the frame or glasses should be kept close and warm until the plants appear, when air should be freely admitted. The plants ought to be pricked out in the same kind of soil as that recommended for the previous sowing.

A third sowing for a late crop may be made about the middle of April, on rich soil or compost, on an open border facing the south. The plants, when fit, may be pricked out, and afterwards transplanted to a nursery-bed; or, if raised thinly, they can be transferred direct to the trenches. A small sowing for a very late supply may be made in May.

Preparation of the Ground.—The ground having been selected, the direction of the trenches, their distance apart, and their width should be determined. Their direction ought to be north-and-south, as admitting the fullest exposure to light. They should be marked out 18 inches wide with 4 feet between the rows. This should be done some time previous to the time of planting. The trenches should be 18 inches deep, well broken up at the bottom with a fork, adding plenty of well-decayed manure, and treading it as the filling-up proceeds. It is a mistake to plant Celery in deep trenches.

Some growers make the trenches a spade's width or about 12 inches, others 15 inches, and some as much as 18 inches. For general purposes they should not be less than 15 inches wide at bottom, and to this width the soil should be worked out and manured. When the distance between the trenches is 4 feet or upwards, they may be 18 inches wide.

The depth of the trench depends on the quantity of manure intended to be put into it. The market-gardeners near London dig trenches two spades deep, fill in a foot deep of strong manure, and over that 3 or 4 inches of soil, and in this the young plants are inserted. Near Manchester, where excellent Celery is produced, the trenches are taken out 18 inches wide and 1 foot deep; then 9 inches deep of compost is introduced, so that the plants are thus within 3 inches of the original surface.

The trenches should be cut with the sides as nearly perpendicular as the texture of the soil will permit, except near the top. They should be made, if possible, as wide at the bottom as at 9 inches above it. The other 3 inches next the surface, together with the soil taken out of the trench, ought to slope backwards. The object of this is to form a wide receiver for rain, and to expose the plants to more light.

The trenches ought to be got ready as early as possible. Not only does this admit of the ridges between being cropped with Lettuce, Kidney-Beans, Peas, and Onions, but it also allows good time for the soil and manure in the trenches to become mellowed. If got ready well in advance of planting-time, advantage can always be taken of showery weather as soon as the young plants are ready.

The manure for the trenches may consist of a mixture of horse and cow dung, or rotten dung and fresh maiden loam, and if leaf-mould or a little peat-soil can be added, so much the better. Horse-dung should not be used in a dry littery state; it should be partially fermented, turned, and watered, till reduced to a moist consistency. The manure is usually turned over, and some soil turned up for planting in; but if the bottom is of a cold nature, it is better to use some of the top-soil for this purpose, unless indeed the trench contains a sufficient depth of compost into which the plants can be inserted.

The plants should be carefully taken up with balls by means of a trowel, and placed upright side by side on a hand-barrow. Previous to planting, every offset or side-slip may be removed. The distance asunder at which the plants may stand in the row varies from 9 to 18 inches. The latter should be adopted where large heads are to be grown for competition.

Planting in Beds.—The ground should be marked out in 6-feet widths, and in such a position that the rows, when planted across them, will be north-and-south; the surface of the ground in the intervals will thus be directly exposed to the heating influence of the sun's rays at noon; whilst both sides of the row will be equally exposed to light. Each alternate 6-feet space is dug out about a foot deep, and the soil laid right and left on the intermediate spaces. If the ground has not been previously trenched, the bottom, after the foot of soil has been taken out, should be deeply dug over, especially for late Celery, in order that superfluous moisture may pass downwards. The directions for the manure or compost for the trenches are also applicable to the beds. Near Edinburgh, where the bed system is preferred by the market-gardeners, the plants are placed 9 inches apart, in rows 14 inches asunder. Nicol directs that the

rows should be 20 inches asunder, and the plants 8 inches from each other in the row. This gives 122 plants per rod, instead of 155, as by the former distances; but the rows may be 16 inches apart, and the plants 8 inches from each other in the rows; then the rod will contain 152 plants, very nearly as many as is obtained by the present Edinburgh practice. The greater space between the rows must be an advantage in earthing up, while the distance of 8 inches between the plants in the row will be sufficient for the size to which Celery in beds is required to be grown.

Subsequent Culture.—This chiefly consists in watering, stirring the surface of the ground, keeping it clear of weeds, removing suckers or side-shoots, and blanching. After transplanting, water should be given, so as to keep the earth moist, but not saturated, till the plants take fresh root. Afterwards, abundance of water should be given. If manure has not been plentifully supplied, manure-water may be given occasionally; but it should not be strong, otherwise a rank growth is induced, and the flavour of the crop deteriorated. The surface of the ground should be stirred when it is rather dry than moist. The outside leaves possessed by the plant at the time of planting never grow to a large size; therefore, when more vigorous ones have been produced, these old and comparatively useless leaves may be removed. This should be done before earthing up takes place. When allowed to remain, they generally rot. In order to kill slugs and other vermin, the surface of the ground and the leaves should be sprinkled with soot.

Blanching.—A leaf, or leaf-stalk, grown in the dark is blanched, and the parts so treated are destitute of the green colouring matter, for the production of which light is essential. But the substance as well as the colour of plants grown in the dark is different from that of plants grown in the light. The part of it which is not *grown* in the dark cannot be blanched, as it should be, white, crisp, and tender, by any subsequent seclusion from light. This proves that the practice of allowing Celery to grow nearly to its full size and then earthing it is a mistake. A large plant is thus obtained; the outside or oldest leaves are firm, with strong fibres, and are unfit for use, except when cooked, for the longer the plant grows in the light the stronger its flavour becomes.

The plants should be allowed to grow as freely exposed to light as possible for some time after planting. When earthing up is commenced, the soil should not be pressed too closely against the plants, for the heart-leaves must have room to push up; no soil ought to touch them, neither should the outside stalks be made to surround them closely till the final earthing up. As the plants advance in growth, the earthing up must be repeated at intervals of about ten days, or according as the weather proves favourable for the operation, which should not be performed when the leaves are wet, and the drier the soil the better. Some tie up the leaf-stalks loosely with matting, and then earth up. The best method is to gather the stalks together with both hands, hold them with one hand, and with the other bring as much loosened soil against one side of the plant as may be necessary, then, changing hands, bring up the soil on the opposite side. The heart is thus kept clear of soil. Until the last earthing up, at least, the soil should not be put higher than the tops of the set of leaves next to the outside ones. The leaflets will thus be left exposed to enable them to carry on their functions, and contribute to the growth of the stem and roots. At the final earthing up the soil ought to be put so that the tops are left above-ground.

These directions are for the trench system; but the earthing up of Celery in beds should be on the same principle. The soil is best put to the plants by hand; but it has to be thrown in between the rows from the intervals between the beds, and, unless this is done with care, the soil will get into the hearts of the plants. It will therefore be advisable to use two boards, about 9 inches wide, and in length equal to the width of the bed. These can be placed between the rows to guard the plants on each side whilst the soil is being thrown in between. The boards are then taken up and placed between the next two rows, and so on.

Celery may be blanched by means of sea-sand. Thus treated, it is clean, well blanched, and glossy; and when canker and other enemies attack the plant, sea-sand may be advantageously employed; or, if it cannot be had, clean river-sand, or pure pit-sand of any kind, free from oxide of iron, watered with a solution of salt, may be used instead. In this case the sand should be turned whilst it is watered, in order that the salt may be equally diffused throughout. In applying the sand, boards, or the sheet-iron plates, will be very convenient; they can be placed on each side of the row at a little distance from the plants, and the sand can then be introduced between

the plants and the boards or plates, which can be backed up with soil to support the sand when they are withdrawn. Sifted coal-ashes are sometimes used for blanching, but they frequently contain substances injurious to vegetation; fine soft ballast or charred soil is preferable.

The French sometimes blanch by tying up the stalks, first near the base, next about the middle, and finally near the top. The whole is then closely covered with dry straw up to the top of the leaves. By this treatment Celery blanches quickly and well. Semicircular drain-tiles, placed one on each side of the plant so as to enclose it, have been tried, but not very successfully. If the whole plant is not covered, blanching will be imperfect; if it be completely covered, then the leaves previously healthy in the light will become languid in the dark, and will fail to supply elaborated sap, and a good heart for blanching cannot be produced. The power to do this must be derived from healthy, unblanched foliage.

Fig. 81.—Paper Collars for blanching Celery.

Planting on Raised Beds.—Very fine exhibition Celery is obtained either by planting on the level or on raised beds. Trenches are naturally cooler than soil on the level, and raised beds get the full benefit of both sunshine and atmosphere. If, therefore, the Celery is supplied with all it requires in the way of food and moisture at the roots, coupled with a considerable increase of warmth and aeration, it is bound to grow to a greater size and more rapidly than it does in trenches. It would not pay to grow Celery for ordinary use on or above the ground-level, owing to the extra amount of trouble that must be expended in effecting a perfect blanch of the stalks. The exhibitor begrudges no time or labour if only he can win prizes, and his few dozen plants, grown under extraordinary conditions, usually more than compensate for the pains taken with them.

Before the plants are put out solid manure ought to be freely dug in and the soil got into a finely divided state, leaf-soil, burnt soil, and fine mortar rubbish being good for heavier ground. Those who adopt the plan of growing exhibition Celery on raised beds enclose a square plot of ground with stout boards, supported by stakes driven into the ground. The best of the top-soil is then thrown out, and good rotten manure very liberally forked into the subsoil. When the top-soil is returned, with it is mixed an equal quantity of fresh loam, with ashes from a garden smother or slow fire, leaf-soil, and well-decayed manure, a light sprinkling of salt also acting beneficially. When well mixed this forms a compost that Celery quickly takes to.

In order to have well-blanched Celery in the first fortnight in August, the plants must be raised in February and kept growing strongly under glass till near the middle of May. They will experience the least check if moved from the boxes in which they were first pricked out into 6-inch pots—one in each. They ought to be kept near the glass, a shelf in a warm greenhouse suiting them, after they are established in pots, and never

be allowed to become dry at the root, or to get badly root-bound. Plant them on the square, and about 20 by 15 inches. When growing on either raised beds or on the ground-level an extra allowance of water must be given, liquid manure also promoting vigorous growth, and a mulch of old potting soil ought to be given early in the summer.

Obviously moulding up Celery grown in the manner just indicated is out of the question, nor is it necessary or desirable, blanching being far more easily effected by means of brown paper, moderately strong, and cut into bands 5 inches wide. Remove all side growths, keeping the stalks as upright as possible. It is not advisable to paper all the plants at once that are required in August or September, and five to six weeks should be allowed from the commencement to the finish of placing the bands on. To fix the bands first remove a little soil at the base, and wrap the band around the plant in three turns, making secure with raffia. A little soil can be drawn around to exclude the light. In eight or ten days another band may be put on. First remove the last band, to examine for slugs or other pests. This should be continued until the banding is complete. Take care not to fasten the band too tightly. The plants should be well syringed over and abundance of water given. Aldenham Pink is one of the best for blanching.

Protection.—Although Celery is hardy in its natural state, yet under artificial treatment it is apt to perish in winter. At that season its oldest leaves, like those of other herbaceous plants, naturally begin to decay, and the central portion, though young, is unfitted for resisting frost, in consequence of its having been blanched. The alternate action of frost and wet soon causes it to rot, and frequently wet alone has this effect. Snow and hail, descending to the centre, check the growth, and cause rot.

In the usual way the stalks are kept upright, so that water from snow melting on the top readily passes down amongst them; but by bending the tops towards one side at the last earthing up, or even commencing to do so at the previous earthing, the rain or snow water would not have a direct downward course. Tough dry turf, or some substance that would not wash down into the hearts of the plants, might be laid on the upper side of the bent Celery tops. Various other means of protection could easily be devised. Thatched hurdles afford good protection, as also do boards nailed together ∧-shaped fashion, and placed over the rows. Some growers use leaves which have been previously heated, and remain in flakes of some 6 inches in thickness, and which resist alike the action of frost and moisture. This covering is removed in favourable weather, and the plants exposed to air, as they should be in all cases. Dry fern, long litter, or any other substance that will form a light covering and resist frost, may likewise be used. Some plants may also be taken up and buried in sand or light soil, under shelter, leaving, however, the tops of the leaves uncovered.

To save Seeds.—Select some of the finest plants, mark them in order to give them but very little earthing up, and protect them in severe weather. Early in spring they should be carefully taken up and planted in a sunny situation. They should be well watered, and the flower-stems supported by stakes. The seeds ripen in autumn, and keep good for three or four years; but the newest seeds are the best.

Celery is liable to canker in some soils, particularly in such as contain much oxide of iron. A parasitic fungus also grows upon the leaves.

Fig. 82.—Celery—Standard Bearer.

Enemies.—Celery Fly, Aphides, Celery-stem Fly. See chapter on *Insects, &c.*

ALDENHAM PINK.—A first-rate variety either for early or main crop, stems solid and crisp and bright in colour, easily blanched. Good for exhibition.

CARTER'S GIANT PINK.—A superb, large growing variety.

DWARF SOLID WHITE (Incomparable Sandringham).—Dwarf and compact; leaflets small, pale green; hearts solid, pure white, blanching about 10 inches; the stalks broad, thick, fleshy, crisp, and of fine quality. One of the best, as it blanches readily, is early, and stands the winter well.

IVERY'S NONSUCH (London Market Red).—Strong, vigorous, about 3 feet high, and with an average girth of 12 inches; hearts very solid, blanching for about 12 inches; the stalks broad, thick, and crisp, with a nutty flavour. Stands the winter well.

MAJOR CLARKE'S RED.—Very compact, erect, and even, about 3 feet high; leaflets rather small; hearts very solid, blanching well for about 12 inches; the stalks broad, thick, crisp, with a nutty flavour. One of the best for autumn and summer use.

MANCHESTER RED (Giant Red).—Strong and vigorous, about 3 feet high and 12 inches in girth; leaflets broad; hearts very solid, blanching for about 12 inches; the stalks broad, thick, and fleshy. Excellent in quality; stands the winter well.

SOLID WHITE.—Of close habit, 2 feet high; leaflets broad, deeply toothed or serrated; hearts firm and solid, blanching for about 12 inches; the stalks broad, thick, crisp, and tender.

STANDARD-BEARER (fig. 82).—A sturdy and hardy form of Major Clarke's Red, and should be grown in preference to it in cold localities.

WRIGHT'S GIANT GROVE (fig. 80).—Habit spreading; hearts solid, blanching to nearly 14 inches; the stalks broad, thick, and fleshy. One of the largest whites, apt to become pithy if very strongly grown.

CELERIAC.—The Turnip-rooted or Knob Celery (fig. 83) is a variety which forms, under favourable circumstances, a tuberous base, and this is the part chiefly used, either sliced as an ingredient in salads, or cooked. It is much esteemed on the Continent, especially where the frost is usually so intense as to render it impossible to preserve the other kinds fresh during winter. Celeriac roots can be taken up and stored out of the reach of frost. They may be grown to a weight of from 3 to 4 lbs.

Culture.—The seeds should be sown early in March, and for succession in April, in a slight heat under glass, or under a hand-glass on a warm border, and afterwards pricked out as for true Celery. In the beginning of June the plants should be planted out on the level ground in moderately rich and rather sandy soil, in rows 24 inches apart, and at 18 inches from each other in the rows. Before planting, all lateral shoots and some of the outside leaves, likewise the lateral fibres on the root, must be removed. The plants ought to be planted shallow, the roots scarcely so deep

Fig. 83.—Turnip-rooted or Knob Celery.

in the ground as they had formerly been. Abundance of water should be supplied. Occasionally a little of the soil must be taken from around the roots, and all lateral fibres removed. When nearly full-grown the roots should be covered with soil to render them whiter than they otherwise would be. They should be fit for use in September or October; and before winter, should be taken up, divested of all the foliage except the heart-leaves, and placed amongst sand in a shed or cellar. A good sort is *Carter's Improved*, which has a pure white root with refined flavour.

CHAMOMILE (*Anthemis nobilis*).—A hardy native perennial, the flowers of which have long been used as a stimulating tonic. A strong infusion of them also acts as an emetic when taken warm.

There are single and double-flowered varieties, the latter being preferred on account of the greater bulk of its flowers. Chamomile prefers a dry soil, and though it may be raised from seed sown early in spring, is usually propagated by dividing the roots in March or in autumn, or by offsets. The divisions should be planted in small patches, 9 inches apart, and water should be given at planting, and subsequently till they take root; after that they soon spread and cover the ground. The flowers ought to be gathered when just opened, and suc-

cessively as they are produced; and after having been slowly and thoroughly dried, they may be stored like other herbs.

CHERVIL (*Anthriscus cerefolium*) (fig. 84).—An annual, native of the south of Europe, cultivated for its leaves, which when young are used in salads and to flavour soups.

The seeds may be sown in shallow drills, 12 inches apart, covering very lightly with mould. The first sowing must be made in October for spring use; and if a constant succession of tender leaves is required, successional sowings should be made every month from the end of February till September. In summer, it should be sown in a shady situation, and a warm position should be chosen when the weather

Fig. 84.—Chervil (*Anthriscus cerefolium*).

is cooler, and when consequently the plants are not so apt to run to seed.

BULBOUS-ROOTED CHERVIL (*Chærophyllum bulbosum*) (fig. 85).—A hardy biennial, a

Fig. 85.—Bulbous-rooted Chervil (*Chærophyllum bulbosum*).

native of South Europe, producing fusiform roots somewhat resembling a small Parsnip, or about the size of an Early Horn Carrot; flesh yellowish white, farinaceous, rather sweet, with the flavour of Chervil. They are eaten boiled, and are said to be more farinaceous than the Potato, resembling more the Chestnut.

The seeds should be sown in drills, in any good garden soil, in August, September, and October, but if later than this the plants will not come up till the second year. As the seeds often perish in the ground in winter, it is a good plan to stratify them soon after they are gathered. This operation consists in putting a layer of fine sand in a large flower-pot, then a layer of seeds, then one of sand, and so on alternately till the pot is full. It may then be plunged in any spare corner, and protected from frost; and it may thus remain till February or March, when it may be sown where intended to remain to produce the crop, covering the seeds lightly with fine soil. The roots will be ready to take up in July, when the leaves become withered. They should be kept, like Potatoes, in a dry dark place. The produce is from 60 to 70 lbs. per square pole or perch, or a dish from about a square yard. It is therefore worthy of trial as a rarity, and it is doubtless capable of improvement.

CHICORY (*Cichorium Intybus*) (fig. 86).—A hardy native perennial, growing by roadsides and in waste places, particularly in calcareous soils.

In the garden it is grown chiefly as a salad plant, and as such it is not so generally cultivated as it deserves. The leaves, when cut quite young, constitute a rather bitter but very wholesome small salad, much esteemed in Paris, but not much used in this country. When blanched, the leaves furnish the excellent winter salad known by the name of *barbe de capucin*. The large fleshy roots are cultivated on an extensive scale for mixture with coffee, on the inferior sorts of which its addition effects a decided improvement. For this purpose the fresh roots are cut into small pieces, dried on a kiln, roasted, and ground. The leaves are also an excellent fodder, and are greedily eaten by cattle of all kinds.

Witloof, or white leaf, a variety of Chicory, is much cultivated in Belgium as a salad plant, and is preferred in a blanched state to the Barbe de Capucin and other Chicories grown in France. The part used is the tuft of young radical leaves represented on fig. 87, and this is either eaten raw as a salad, or cooked whole and served with white or cream sauce. Grown and blanched under

similar conditions, it is, however, of doubtful superiority to the improved Chicory.

If Chicory is grown for use as a salad, it may be had all the year round by sowing

Fig. 86.—Chicory (*Cichorium Intybus*).

every fortnight or three weeks in the open ground, or on a hot-bed, according to the time of the year. In general, however, sowings in the open ground from the end of April to the end of October is sufficient. An open position should be selected, and as it produces long carrot-shaped roots, the soil should be well prepared. Some that was manured for a previous crop is suitable. It should be bastard trenched in order that the long tap roots may meet with no obstacle in their downward growth. During May and June one or two sowings should be made in drills 15 inches apart, and when the plants are large enough to handle they should be thinned out to 12 inches apart. The ground should be kept well hoed. By the end of October the larger leaves will have decayed, leaving only a few small ones in the heart of the plant. About three or four weeks before they are required for use, a sufficient number should be lifted with a fork, removing the foliage to just above the crown. Before sharp weather sets in a mulching of litter is given to prevent the frost penetrating into the ground. As snails are particularly fond of Chicory, especially when the plants are young, it is advisable to sprinkle a little soot over the beds as soon as the plants are above ground.

Blanching.—The lifted roots should be placed in deep boxes or in one corner of the mushroom house, or some suitable place where light can be excluded and where there is a little heat. They should be planted in old potting soil which contains just sufficient moisture to keep the root fibres in action. An occasional syringing with tepid water may be given. In planting, the crown should stand at least ½ inch above the soil, and any loose soil should be removed from about the leaves with a syringe, in order that the young foliage may be perfectly clean when cut. In about three weeks the leaves will have made growth, and if they have been kept in perfect darkness the colour will be a delicate creamy white.

After the earlier forced roots are removed they may be returned to the north border, and have a little old tan strewed over their crowns. Here their strength will in some measure be recruited, and they will bear forcing a second time, thus producing a second crop of leaves towards the middle or end of March. These leaves will be pushed from the lateral buds around the base of the crown, if in the first cutting it has not been pared too close; they will not be so fine as the first crop, still they are very useful late in the season, if the supply of roots is limited.

An easy, and at the same time an effectual, method of blanching Chicory leaves in a comparatively light house is to have a few wooden boxes constructed, about 12 or 14 inches deep, and to invert these over the plants. Each box should be large enough to cover a sufficient number to supply a respectable salad for a week, which will vary from one to three dozen, according to the requirements of the family. By proper attention to removing the old roots in rotation, and substituting fresh ones, a supply of excellent salad may be obtained from three or four of these boxes.

Any one who possesses a garden in which to grow the plants in summer may blanch them in a cellar with little trouble, if it is kept sufficiently dark, except that it will require three weeks to produce leaves of the

requisite length. The readiest way is to form a stack in one corner, laying the roots horizontally in sand as you would to preserve Carrots. The roots should not be all put in at once, but a layer or course of roots should be brought in once a week, and by the time the fourth course is in the first will be ready to cut. Under this system the old roots should not be removed, but retained to produce a second cutting; and by taking advantage of this property it will not be necessary after the first four or five weeks to bring in a fresh supply of roots oftener than once every fortnight or three weeks. This is a cheap method of procuring a first-rate winter salad.

As Chicory commences to grow very early, the blanched leaves may be obtained out-of-doors in February and March, by planting the roots in a moderately dry border, and inverting a close box over them, in the same manner as directed for growing them in the Mushroom-house. By this method a somewhat longer time will be necessary to produce leaves of the requisite lengths, for which reason it need only be resorted to when others are not convenient.

The French, who excel in the production of Chicory, sow the seeds thinly in April or May. In November or December beds of light sandy soil, or well-decomposed dung, about 2 feet in width and 3 inches thick, are formed in a cellar. On these is placed a row of Chicory roots laid on their side, with the crowns outwards; next comes another layer of earth of the same thickness as before; then another row of roots; and so on. The mild and equable temperature of the cellar, and the want of light, soon cause the development of blanched leaves, which are cut as soon as they have attained a sufficient size. Water must be given as required if the soil used is dry.

Fig. 87.—Witloof Chicory.

Near Paris a more expeditious method is pursued; beds of hot dung are made up, and the roots of Chicory, tied up in bundles, are placed in an upright position upon the beds, and watered from time to time so as to keep them moist. Another method of blanching without taking up the roots consists in sowing in drills from 6 to 8 inches asunder, and covering the Chicory in February with 4 or 5 inches thick of earth, or with double that thickness of leaves. In three weeks or a month afterwards, according to the season, it furnishes a crop of young leaves, which are very white and tender.

In order to save seeds, a few plants may be left through the winter. They will flower in July and August, and ripen their seeds in autumn.

The varieties grown in France are: Coffee Chicory (*Chicorée à café*), Improved Chicory (*Chicorée sauvage améliorée*), and Variegated Chicory (*Chicorée sauvage améliorée panachée*).

The varieties grown in England are:—

Large Brussels (Witloof) (fig. 87).—This has large leaves with wide midribs and stalks. When blanched it is not unlike a Cos Lettuce in appearance. It is eaten raw as a salad, and also boiled like Endive.

Large-rooted.—Grown chiefly for its Carrot-like roots, which are employed in the manufacture of Coffee Chicory.

Red Italian.—Remarkable for the rich-red colour on the blanched leaves, which makes it a favourite to mix with salad.

CHINESE ARTICHOKES, Crosnes du Japon, Spirals (*Stachys tuberifera*) (fig. 88).—A hardy tuberous-rooted perennial, and a welcome addition to winter vegetables. The plant grows from 10 inches to 15 inches in height, with a branching head. The principal root, or what may be termed the underground portion of the stem, forms numerous fibrous roots, to which are attached spiral tubers, pearly-white in colour, 2 inches or rather more in length and about half an inch in thickness, both ends being tapering. They are cooked either by roasting, boiling, or steaming, and served with melted butter and other sauces form an excellent dish. Though most appreciated in a cooked state, they are yet sometimes eaten raw, and are not unlike a mild Radish in flavour, with just enough of the taste of a Jerusalem Artichoke to have suggested the name of Chinese Artichoke for them. They are quite hardy and of the easiest possible culture, in fact there is a possibility of their becoming a troublesome weed wherever the crops are not lifted. At the same time a certain amount of pains ought to be taken with them, or otherwise the tubers may prove too small to be serviceable.

A moderately rich, free, working soil is desirable, and in this drills may be drawn 18 inches apart, and strong whole tubers be planted from 9 inches to 12 inches apart,

in fine soil. In cold low-lying positions raised beds 4 feet wide should be formed to hold three rows. The best crops of well-formed tubers are had from ground in a

Fig. 88.—Chinese Artichoke (*Stachys tuberifera*).

finely-divided state, which offers no obstructions to the free growth of the tubers. All that is further needed is to keep the surface of the ground loosened and free of weeds. It will be found that the tubers keep fresher in colour and more tender in the ground where grown, digging them as required for use, but they ought all to be lifted before active growth commences in the spring, this also being the best time to replant. Those who prefer lifting the crops when the tops die down ought not to expose the tubers longer than necessary, as this discolours them, and they must also mix them with moist sand or fine soil, or otherwise shrivelling and decay quickly takes place.

CHIVES (*Allium Schœnoprasum*).—A hardy native perennial, cultivated for its leaves, which are used in salads and soups instead of young Onions.

It will grow well in almost any soil, and is propagated by dividing the tufts in spring or autumn, and planting them in small patches, 6 inches apart, in rows from 9 to 12 inches asunder. The plants soon form large bunches of leaves, which become the more tender the more frequently they are cut. Chives should be replanted about every three years. This is done by dividing up the old plants, using a fresh piece of ground for them. The ground between the rows should be kept hoed, and occasionally a light dressing of soil will prove beneficial. Some cut the plants down in autumn, and after leaving them for some time to dry, cover them with an inch or two of mould.

CHOU DE BURGHLEY, or CABBAGE BROCCOLI.—This is said to have been originated at Burghley, by crossing a Cabbage with a Broccoli. It can be used as a Cabbage in the autumn or early part of the winter, or kept till the spring, when those that survive will be found to have a Broccoli-like heart. Isolated plants that exactly agree with these particulars can, nearly every season, be found among breadths of Snow's Winter White and other Broccoli, and if seed is saved from any of these a form of Cabbage Broccoli will result.

When first sent out, very many cultivators erred in growing it too strongly. The seed was sown either in gentle heat in February or March, or else in the open in the latter month, and being duly prepared and got out early on rich ground, the plants grew to a great size and produced immense solid, conical hearts, ready for use in the autumn, but which no good cook would look at. When, however, smaller and blanched hearts are forthcoming late in the autumn and during the winter, for it is quite hardy, their delicate flavour is appreciated by most people.

The seeds should be sown in the open during the first week in April, and again near the end of that month. Draw drills 4 inches apart, give a gentle watering if at all dry, sow the seeds thinly and cover with fine soil. Thin out lightly wherever there are patches of plants, and when about 5 inches high transplant into firm, moderately rich ground 18 inches asunder, in rows 2 feet apart. During dry weather, or till such times as the plants are well established in their fresh quarters, give occasional waterings, and draw a little soil up to their stems before the plants cover much of the ground. In this manner an excellent supply of neat, conical, blanched hearts is obtained during December, January, and February.

CLARY (*Salvia Sclarea*).—A biennial, native of South Europe. The leaves are used in soups. The seeds are sown in April, in drills 12 inches apart, and when the young plants are 3 inches high they are thinned out to 1 foot apart in the row. The subsequent culture is confined to keeping the ground clean, and an occasional hoeing. The leaves may be gathered and stored for use till the following summer. The plants flower in August, and die soon after the seed is ripe.

CORIANDER (*Coriandrum sativum*).—An annual, native of South Europe, and said to be wild in some parts of England.

Its young leaves are put into soups and salads, and the seeds are extensively employed in confectionery, for disguising the taste of medicines, and by distillers; they are also used in soups and some other food dishes. A sowing should be made in April to produce seeds, but for a supply of young leaves sow from May to August.

CORN SALAD, or LAMB'S LETTUCE (*Valerianella*).—Much esteemed in France as a small salad, and as a substitute for Lettuce during the winter and spring.

Two species, both annuals, are cultivated, viz. *V. olitoria* (Common and Round) and

Fig. 89.—Italian Corn Salad (*Valerianella eriocarpa*).

V. eriocarpa (Italian) (fig. 89). The whole plant is used.

Corn Salad is raised from seeds sown on a bed or border of light rich earth, manured the preceding year. It should be sown, and lightly raked in, or in shallow drills 6 or 8 inches asunder. All the culture required is confined to watering the seed-bed and young plants in dry weather, and to protecting them with long litter during severe frost. The plants will be sufficiently thinned by removing the most advanced for consumption, leaving the youngest to come in for use in succession.

The first sowing may be made in the beginning or middle of August, and from that time till the end of October a small quantity may be sown every week or fortnight, according to the demand. These sowings will afford a supply for autumn, winter, and early spring use. If required in the latter part of the spring, and in summer, it may be sown monthly from the beginning of March till the end of July. Seeds are saved by allowing some of the plants to run, and, as they are easily shed, they must be gathered as they ripen by spreading a cloth under the plants, which are then shaken. This having been repeated on several occasions, as the seeds successively ripen, the plants are finally pulled up and hung in a shed to ripen the remainder. The seeds remain good for six or eight years.

CRESS, American (*Barbarea præcox*).—The American or Belle-isle Cress is a native perennial, growing naturally by the sides of brooks. The leaves are used for the same purposes as those of the common Cress. It prefers a light and somewhat moist soil. It is raised from seeds, which should be sown thinly in shallow drills 9 inches asunder, thinning out the young plants to 4 inches apart in the row. A sowing for winter and spring use may be made in the beginning of September. To have tender leaves in winter, some plants of this sowing should be transplanted to 3 or 4 inches apart, so that they may be covered by hand-glasses in severe weather or with dry litter. If required in summer, seeds may be sown in a warm situation in March, and again in May and July; but if in constant demand, they should be sown monthly from March till September. All the culture required is to water occasionally in dry weather. In gathering, the plants may either be cut over, but not too close to the ground, or the leaves may be gathered singly; in either case fresh leaves for another gathering will be produced.

CRESS, Garden (*Lepidium sativum*).—A hardy annual, native of Persia. It has been cultivated in this country since 1548.

For a succession during the summer months choose a shady cool border, which should be made quite level and fine as possible, sowing the seed thickly in widths of 6 inches and as long as desired, pressing them down with a board, not covering them with soil. A sowing should be made about every

ten days to maintain fresh supplies. In hot weather a mat may be placed over the beds to assist germination, which should be removed in about three or four days. For winter and spring make frequent sowings in boxes and place in a temperature of 55°.

CRESS, Water (*Nasturtium officinale*).—A hardy native perennial, growing wild in ditches and small streams. It is considered to possess antiscorbutic properties; it is also said to contain iodine, to which probably some of its virtues may be attributable. It is extensively cultivated for the London market. At Erfurt, and in the neighbourhood of Paris, large quantities are also grown. Propagated by seeds; but, in forming plantations, seedlings from the natural habitat of the plant, or rooted divisions, are usually employed.

There are three sorts, namely, *Green-leaved*, *Small Brown-leaved*, and *Large Brown-leaved*. The Green-leaved is the easiest of cultivation, and the Small Brown-leaved is the hardiest, whilst the Large Brown-leaved—which, on account of its appearance, and probably also from its having a less proportion of stalk to the leaf, is preferred in the market—is the only one which can be well grown in situations where shallow water is not to be obtained. At Northfleet, Springhead, the plants grow better, and had a superior flavour, when disposed in rows parallel with the course of the stream than when left in irregular patches. When in rows they are more regularly exposed to the influence of the current, and the water is not so much impeded in its course, because there are regular open channels between the rows. It is also more easily gathered from the rows, and more readily freed from weeds and *débris*. It was found necessary to vary the spaces between the rows according to the depth of the water. When it is deep the rows are 5, 6, and even 7 feet apart, whilst in shallow waters about 18 inches between the rows is sufficient. The plants thrive best in shallow water, that is, when the depth is about 1½ inch, increased to about 3 inches when the plants begin to grow and thereby to check the current. In deep water the roots are easily drawn out of the soil, which makes it difficult to gather the vegetable freed from the roots; if, therefore, a sufficient space covered with shallow water could be obtained the deep water would not in any case be used.

The shoots are cut for market, not broken off, which is the usual mode of gathering the wild Cress, and is very injurious to the plants in the beds. After frequent cuttings the heads are smaller.

The most expensive part of the cultivation is the necessity of clearing out and replanting the beds twice a year; as mud collects about the roots, and duck-weed and other plants become intermixed with and choke up the Cress, it is almost impossible to pick it in a fit state for market after the plantation has been made five or six months.

The mode of replanting is to remove all the rows of plants, beginning at the stream-head, and then clear the bed of the stream from mud and rubbish; which, however, it should be remarked, make excellent garden-manure. From the mass of plants thus taken out, the youngest and those with most roots are selected; these are placed on the gravel in rows, at the requisite distances, with a stone on each plant to keep it in its place.

The Cress will not grow freely in a muddy bottom, nor will it taste well when there is mud about the roots, which should be carefully removed and replaced by gravel or chalk. It is absolutely necessary to have a constant current, as, when there is any obstruction to the stream or flow of water, the plants cease to thrive. The times of renewing the beds are May and June, and from September to November. The planting is done in succession, so that the crops may come regularly into cutting. Those planted in May are fit to cut in August, and those planted in November are ready to gather in the spring.

After the plants have been cut about three times they begin to stock, and then the oftener they are cut the better. In summer it is necessary to keep them very closely cut; and in water of a proper depth, and with a good soil, each bed supplies a gathering once a week. In winter the water should be rather deeper than in summer (4 or 5 inches); to obtain this the plants are left with more head, that the water may thus be impeded.

It is essential that the plantations should be made in fresh or newly risen spring-water, as the plants not only thrive better in it, but, in consequence of its being rarely frozen, they generally continue in vegetation, and in a good state for gathering, throughout the winter season.

Water-cress may also be grown in a shady border of rich soil, covered with a thin layer of sand to keep the leaves clean, and kept constantly moist by frequent waterings; but in this way the produce is inferior in

quality to that obtained from plants grown in living water. It may be grown in tubs, boxes, and pans partially filled with soil, covered with water. The water should be frequently drained off and replaced by fresh.

The cocoons of the Water-cress Fly (*Tipula reptans*), as well as the eggs and larvæ of various other insects, are found on the Water-cress, and sometimes cause much inconvenience when eaten; it should therefore be steeped for some minutes in salt water, and then washed well in fresh, before it is served.

CUCUMBER (*Cucumis sativus*).—Cultivated in all warm and warm-temperate countries, but its origin is not known. It was cultivated and in general use in Egypt in the earliest ages. In Rome recourse was had to artificial means to obtain its fruits throughout the year. The mode of effecting this for the table of the emperor Tiberius was not widely different from that employed in the present day. Heat was obtained in frames filled with hot dung, and light was admitted through thin plates of talc, which would doubtless answer the purpose exceedingly well, especially under the strong light of an Italian sky. Pliny mentions beds mounted on wheels, so that in cold weather they could be removed under the shelter of buildings at night. The plants were also reared in baskets or in large vases, in order that they might be placed in the open air when the temperature was favourable, and taken indoors when it was otherwise.

The Cucumber requires for its successful cultivation a rich light soil, a bottom-heat of from 75° to 80°, and a top-heat between 70° and 80°. Moisture ought not to be at any time deficient; and it is of the utmost importance that the foliage be exposed to as much light as possible. No shading is necessary, providing air is admitted early in the day, and the ventilators closed early in the afternoon.

Soil.—The soil in which the seeds are to be sown singly in thumb-pots should consist of three parts well decayed leaf-soil, one part light loam, with sufficient sand to keep it open. Water in and plunge in a strong bottom-heat. The most suitable soil for fruiting the plant is good turfy loam, which has been stacked for six months, to which may be added a little finely broken charcoal and fine mortar rubble. For winter cultivation a lighter compost is required; it should consist of two parts loam and two parts well-decayed leaf-soil. No manure is necessary until the plants become established, when some may be added as a surface dressing.

The Cucumber will grow vigorously in common garden soil, and it may be observed how healthy plants are when growing in the open air and exposed to full light. This method, however, is uncertain; means must therefore be employed to produce artificial heat, as well as shelter from cold winds, rain, and snow. The mode of doing this was formerly confined to dung-beds and linings, by which heat could be obtained with little expense in the first instance; but various other methods are now employed, rendering the maintenance of a proper degree of heat, even in the middle of winter, less precarious.

Treatment.—To obtain a supply of Cucumbers in winter the best plan is to employ structures heated with hot water; but where the necessary outlay for houses or pits cannot be made, it is better not to attempt very early forcing by means of dung-beds, indeed no earlier than is consistent with the chance of being successful with a moderate amount of labour applied on good principles. Keeping this in view, the seeds may be sown early in February.

About the first week in February a quantity of good stable-manure, to which should be added two parts good fresh leaves, oak, Spanish chestnut or beech for choice, should be placed together in a conical heap, and mixed thoroughly. When the heap is in a full state of fermentation, it should be turned and mixed thoroughly. In a few days it should again be turned, and when fermentation has for a third time become general, the formation of the bed may be commenced.

The situation of the bed should be sheltered, but open to the south. The less obstruction to the full light from this quarter the better. The dimensions of the frame being known, an area 18 inches larger should be marked out, so that when the bed is built up and the frame placed, it will be 18 inches from the outside of the bed at both sides and ends. Some put a layer of brushwood on the ground, others long dung. Proceed next to form the bed, layer after layer, the materials of each being well shaken and mixed, and then beaten with the back of the fork, so as to be uniformly compact. The upper layer should consist of some of the shortest materials. The bed should be level when completed, and about 4 feet high. The frame should then be put on, and the lights kept close till the heat exceeds 80°, when the sashes ought to be raised to permit the escape of moisture.

After the bed has been allowed to settle for a few days, the heat may easily be tested by placing in it a plunging thermometer. For a practical man even the thrusting in of a stick will serve the purpose. In any case the compost in which the young plants are to be planted should not be risked by overheating. It will be necessary at this early season to raise the seedlings in a forcing-house. The compost should be placed in a ridge along the centre of the frames, thus allowing for adding fresh material as the plants develop. After the soil has become nicely warmed the young plants may be put out, laying them on one side, and the growth pegged down. When about a foot of growth has been made, pinch out the points, and endeavour as far as possible to promote a stout, sturdy growth. Care should be taken to maintain an even temperature of about 70°, rising to 80°, or even more with sun heat, and in all cases ventilate early. It will be necessary to cover the lights with mats in cold weather at night, and frequent linings of new fermenting material will have to be added.

Watering.—Cucumbers should always have plenty of water regularly supplied, the demand increasing as the plant develops. It depends also on the temperature, and on the amount of ventilation. Care should be taken that the temperature of the water, both for watering the bed and for syringing, is about the same as that of the soil in which the plants are growing. Watering and syringing should always be done when the lights are closed in the early afternoon.

Ventilation.—Air requires to be admitted with great caution, when the disparity between the temperature within the frame and that of the external air is considerable. Young plants are naturally tender after growing in a warm, moist atmosphere; therefore in winter and early spring little air should be given. It must never be given to lower the temperature, but rather to prevent it from becoming too high; for example, if 90° may be permitted by sun-heat, air should be given in such time and manner as will prevent the temperature from rising above that point, instead of allowing it to rise, say to 100°, and then lowering it to 90° by giving a large amount of air. Doubtless the true principle of giving air is to admit it as progressively as the temperature increases. This, of course, could not be carried out in practice; nevertheless, it should be borne in mind and acted on as far as circumstances will permit.

Endeavour as far as practicable to ventilate in the opposite direction to which the wind is blowing. Very little indeed will be needed when the wind is north or north-east, but on bright sunny mornings sufficient should be given to let out excessive moisture, or burning of the foliage will result.

Coverings.—Double mats should be used in severe weather, and, if the heat of the bed is not very strong, a thin coating of hay next the glass is a great protection. As the cold decreases the covering may be reduced to a single mat, and in summer that may be dispensed with.

Stopping.—The Cucumber naturally extends its branches to a much greater distance than the width of an ordinary frame, and if they were not restricted they would become overcrowded and weakened in consequence. Stopping the shoots and thinning out the growths is of the utmost importance, and should be done at least weekly, during the warmest part of the day. Encourage laterals needed to fill the frame. Stop at one, two, or three joints above the fruit, according as there is room. All weak shoots ought to be removed at an early stage of their growth, and those which are left should be kept moderately thin and regular. Avoid overcropping and remove the fruit immediately when fit for use.

Crooked Fruit.—In dry weather the fruit is apt to become crooked. To prevent this various means are resorted to. Glass tubes made for the purpose are very convenient; or three pieces of thin board may be nailed together like the bottom and sides of a box, 3 inches wide and 2 inches deep, and lined with three slips of glass. A number of these can be prepared, and they answer the purpose very well.

Training.—Instead of training along the surface, some prefer training the shoots on trellises. To allow space for the leaves, these should be placed from 9 inches to 1 foot from the glass, and from 12 to 18 inches from the surface of the bed, to admit of the fruit growing downwards in a perpendicular direction. The plants must be trained with a single stem to an upright rod till they reach above the trellis, when the leader should be stopped in order to obtain ramifications for covering the trellis. The principal among these must be stopped when other branches are required. Unfruitful laterals ought to be removed, and those which are bearing fruit should be stopped, so as to leave one joint beyond the fruit till such time as it can be seen if a shoot will push from the same joint as the fruit. This can only be satisfactorily practised when

the plants are cultivated in brick pits of a sufficient depth.

House Culture.—By far the greater portion of Cucumbers produced in this country are grown in houses, this in a measure being due to the cheapness with which suitable structures can nowadays be built and heated. In forcing pits or houses every attention can be bestowed upon the plants in all weathers, and with the aid of fire-heat a uniform temperature can be maintained without risk of overheating. Houses are necessary if Cucumbers are wanted in winter and early spring; in fact it is only during the hottest part of the year that either brick-pit or frame culture is resorted to; market-growers rarely, if ever, bother with them. Small three-quarter-span and span-roofed houses, the former facing south, and the later running from north to south and of any length, are suitable, and if ample boiler power and a sufficiency of hot-water pipes are provided to easily keep the night temperature up to about 70°, Cucumber culture will be a comparatively easy matter. Pipes to supply bottom-heat are frequently provided, but they are not indispensable.

Cucumbers ought never to have a great mass of manure and soil to root in, the best results attending the practice of growing them in raised hillocks of open compost, which, with plenty of top-heat, soon become, and continue to be, as warm as required.

The plants should be trained over trellises fixed to the roof at a distance of fully 9 inches from the glass, another 3 inches being desirable if head-room admits.

Raising the Plants.—It is of the greatest importance that the start be made with strong, clean young plants. Sow the seeds and treat them as already advised for hot-bed culture. If wanted very early in the year the first sowing may be made in the first week in November, and this batch may be fruited in pots. To succeed these, sow again in mid-December, the plants raised this time doing good service during March, April, and May. It is unwise to keep old or exhausted plants, the better plan being to raise young plants in readiness to take their place. This is the market-growers' plan, many of whom grow and exhaust three sets of plants in the season. Before the old plants are really exhausted, sow more seeds, allowing from a fortnight to a month, according to the time of year,

Fig. 90.—Cucumbers for Seed.

for the development of the plants. If at any time the young plants are ready for planting before they are wanted, either throw them away and raise more, or shift into 6-inch pots and keep them growing strongly a week or so longer.

It is possible to cut Cucumbers within six weeks of the date of sowing the seeds, but this is very quick work, and eight or nine weeks is nearer the mark. The most quickly-grown fruit are the best as regards quality, and if at any time bitterness is complained of, this may be traced to poor growth and dryness at the root. Young plants produce the handsomest fruit, a fact that would-be prize-winners should bear in mind.

Root Treatment.—Reference has already been made to the kinds of soil or compost that suit Cucumbers, and it only remains to be added that a great mass of this ought never to be used at one time. More failures have resulted from ignorance of this fact than from any other cause, or perhaps all other causes combined. The roots must be kept constantly active on and near the surface of the soil, and once they are driven, or allowed to descend, deeply, or to where they derive little or no benefit from the warmth and air in a house they no longer form sap-producing root-fibres in abundance, top-growth and production of fruit failing accordingly.

It is surprising how small a quantity of soil the most successful growers for the London markets provide for their plants, and also what an extraordinary crop they rarely fail to obtain from them in the course of a month or six weeks' cropping. It is not a question of so many bushels of soil to each plant, but rather of pecks. About a peck should be given to each plant at the outset, and another peck in the form of frequent and light top-dressings. That is the secret. No top-dressing with a heavy weight of fresh soil or enough to smother the old soil and roots at one time, but only sufficient to scarcely hide the roots. These latter then never feel the loss of air, and heat and moisture being constantly supplied to them, they take active possession of the new soil in a few hours.

In addition to supplying water as often as the soil approaches dryness, some manurial assistance must also be given. Once let strong sunshine reach plants dry at the roots, and burning, red spider, and other evils will result; while it is scarcely reasonable to expect plants with a heavy strain on them to derive all the assistance they require from a small mound of soil. At the same time, no manures that would clog the soil and exclude the air from the roots should be used. An occasional light surfacing with some approved fertilizer should be given, or the grower may make one as follows: To 3 lbs. of nitrate of soda add 2 lbs. of muriate of potash and 2 lbs. of superphosphate of lime, about 2 oz. of this for each plant being mixed with the soil used for top-dressing, or 2 oz. may be dissolved in 3 gallons of warm water and applied in that way. Peruvian guano is a good change, using this at much the same rates.

Training.—Instead of topping the young plants as advised in the case of frame cultivation, they ought to be early planted out at about 2 feet apart, and trained upright till the roof trellis is reached—all side shoots below the latter being pinched out as fast as they form. Some growers train the leader straight up the trellis, not topping till the limit is reached. Lateral branches are laid in thinly, right and left, and topped at the second or third joint of both laterals and sub-laterals. In this way a very heavy crop of fruit soon forms, as many as three or four setting at many of the joints.

Market-growers seldom cut off any small fruit, but allow all to attain a saleable size. Naturally this greatly exhausts the plants, and as the sub-laterals produced are not so strong, the fruit is scarcer accordingly. Yet even this ends in the production of what some might consider a good crop. After being once pruned hard back and another crop obtained, it is not long before the plants are rooted out and a fresh lot planted. This pays better than keeping them cropping less heavily for some time longer, though the latter course may be desirable as far as the private grower is concerned, who usually tops his plants when the roof trellis is reached, and frequently after, the shoots only gradually covering the roof. Crowding should be avoided, or the knife may have to be used to cut away shoots that might well have been pinched out earlier.

Syringing.—A free use of the syringe is desirable, especially during bright weather, the plants receiving a thorough and rather forcible wetting when the house is closed early in the afternoon, and again moderately early the next morning. If this fails to keep the foliage free of insect pests, then it is advisable as a rule to start more plants, and as soon as they can be spared, to root out the old ones, as it is very difficult to clean Cucumber plants if once insects get the upper hand. In addition to overhead

syringings, frequent dampings down must also be given. As often as the atmosphere feels dry, or the soil, paths, and walls give signs of dryness, either syringe or damp down heavily. If a hose is used, be careful not to overdo it, or the soil may become saturated. Where little air is given, a modification of what is known as the "express system," in which no air at all is admitted — this maintenance of a moist atmosphere is most imperative. One hour's neglect may end in the loss of much of the foliage by burning. During the growing season the plants will be much benefited by wetting the paths in early afternoon with good farmyard liquid manure.

Low temperatures are most injurious. During the night 70° is none too high, this being gradually increased to 80° without air in the daytime, and from 85° to 90° with, closing in time to run the heat up to about 95°. See also what has already been said with regard to *Ventilation*.

Winter Culture.—In many places Cucumbers are wanted during the late autumn and winter, and if well-heated forcing-houses are available, no great difficulty need be experienced in producing them. They may be grown on small mounds or ridges, or in pots. The latter are preferable, not only for fruiting in autumn and winter, but also for plants to fruit in February and March. In any case they do not continue growing and fruiting during the winter as in summer, and in order to be sure of a steady, continuous supply, fresh plants must be raised. If seeds are sown late in August or early in September, a second sowing late in September, and again a month later. In each and every case a brisk bottom-heat should be provided to hasten germination and induce strong growth.

From the small pots in which the plants are raised shift before they are root-bound, either into 6-inch pots or into their fruiting quarters—using soil that has been previously warmed. Pots varying from 12 inches to 16 inches in diameter are suitable, and these in the first instance should be only about three parts filled with compost, with a view to leaving some room for future top-dressings. Train upright, and pinch out side shoots till the roof trellis is reached, afterwards continuing the leader straight up the roof, laying in side shoots thinly on both sides. Stop the latter at the fourth joint, and do not allow a very heavy crop of fruit to form at one time. Rather more foliage should be left on plants to fruit during the winter than is required when the days are longer and there is more sunshine, otherwise the root action will be sluggish.

The night temperature must range from 65° to 70°, with an increase of from 5° to 10° in the daytime whenever this can be given without making the pipes unduly hot. It will be necessary to damp the walls and surroundings of the pots two or three times a day, resorting to overhead syringing only on bright mornings. Little or no air need be given throughout the winter. Keep the soil uniformly moist, apply liquid manure often, and give a light top-dressing every ten days. Brown fibrous loam in lumps, gradually piled up on and about the pots, is just what the plants most appreciate, a network of root-fibres soon taking possession of it. The plants must be only moderately cropped.

Saving Seeds.— The most successful growers of seeds for the trade start the plants in May or June, and when the trellis or bed is well covered with haulm, the most shapely embryo fruits are carefully fertilized, and three days later once more gone over with a view to removing all that are not of good form. These are allowed to mature and ripen to the point of decaying; they are then cut, sliced open, and the pulp separated from the seeds in water. The good sound seeds will sink to the bottom, and after the water is drained away they may be partially dried, polished in a cloth, and then harvested on an inverted fine sieve in the full sunshine.

Ridge Cucumbers.—Cucumbers may be produced abundantly on ridges in the open air in warm summers, protected in the first instance by hand-glasses. The plants should be raised in heat in April and planted out under hand-glasses on ridges formed over hot dung. In making the ridges a trench should be thrown out 3 feet wide and 1 foot deep, laying the soil on the north side. The trench must then be filled with hot dung, and if this can be raised to the thickness of 2½ feet, so much the better. The dung should be covered with about 9 inches of the soil dug out of the trench, or with other rich soil, the surface being made to slope towards the south, and backed up with the soil thrown out of the trench. The hand-glasses must be kept on as long as the growth of the plants will permit, and on cold nights mats or other covering should be thrown over them. The application of any means that may be contrived to afford shelter on cold nights will of course prove advantageous, as will a mulching of litter; but fresh stable litter is injurious to the foliage.

In the Home Counties, also near Bristol and other large towns, ridge Cucumbers are extensively grown in the open fields. The site preferred is ground sloping gently

Fig. 91.—Cucumber—Matchless.

to the south, and the ridges run from north to south. One foot or so of hot decaying stable-manure is covered by about 6 inches of the best of the soil thrown out of the trenches. This is done early in May—that is, if there is no convenience for raising the requisite large number of plants under glass—and the seed is sown directly the soil has become warm. Sow three or four seeds at distances of 2 feet apart. Protect the seedlings, and also any plants that may be turned out of pots late in May, with bell-glasses (cloches), hand-lights, baskets, or other make-shift coverings on cold nights, or till all danger from spring frost is past, after which thin out the plants where necessary, leaving two at each site. Strong winds are injurious to Cucumber plants, and these to a certain extent can be broken by means of a thick row of Rye-grass disposed between or on each side of the ridges. The Rye seed ought to be sown in the autumn.

It is possible to injure the stems of ridge Cucumbers by a too frequent and free supply of water. Enough should be applied to give the plants a good start, after which they seldom require further assistance in this way. If watering is necessary, risk of injury to the stems may be obviated by keeping it away from them. Setting the plants in a basin of soil simplifies watering operations, but it is unwise and risky all the same.

When the leading growths have attained a length of about 30 inches they should be topped, and beyond keeping them free of weeds no other attention is needed. Best of all, King of the Ridge and Long Prickly are the sorts generally grown. They have fruit about a foot long.

Gherkins.—A small sort of Cucumber, known as *Short Prickly*, is grown for pickling. It is usually sown on ridges instead of being raised under glass and planted out as heretofore. The French growers top the plants beyond the third leaf, the resulting growths spreading and cropping freely.

Varieties.—The varieties of Cucumbers are numerous. A trial of 118 varieties was made at Chiswick in the year 1861 by the Royal Horticultural Society. The 118 were reduced to 15, as furnishing every quality and requirement. Since then many more have been added, all more or less improvements on the sorts they have replaced. A selection of twelve varieties for growing under glass is here given.

For House and Frame Culture

Beckett's Victory.—Fruit 18 inches to 24 inches in length, of good form, few spines, dark-green in colour, carrying a good bloom; quality superior. Plant robust and free bearing. Fine for exhibition.

Beckett's Ideal.—Fruit perfect in shape, colour, and flavour; 24 to 30 inches in length. Is seldom beaten in competition when shown at its best.

EVERYDAY.—Raised in the Royal Gardens, Windsor. Sets fruit freely at all seasons of the year, hence the name. The plant has an excellent constitution, fruit of good length, deep-green in colour, almost smooth, and very attractive in appearance.

SENSATION.—Of fine appearance, of good quality, and free bearing. 24 inches in length. A most desirable variety.

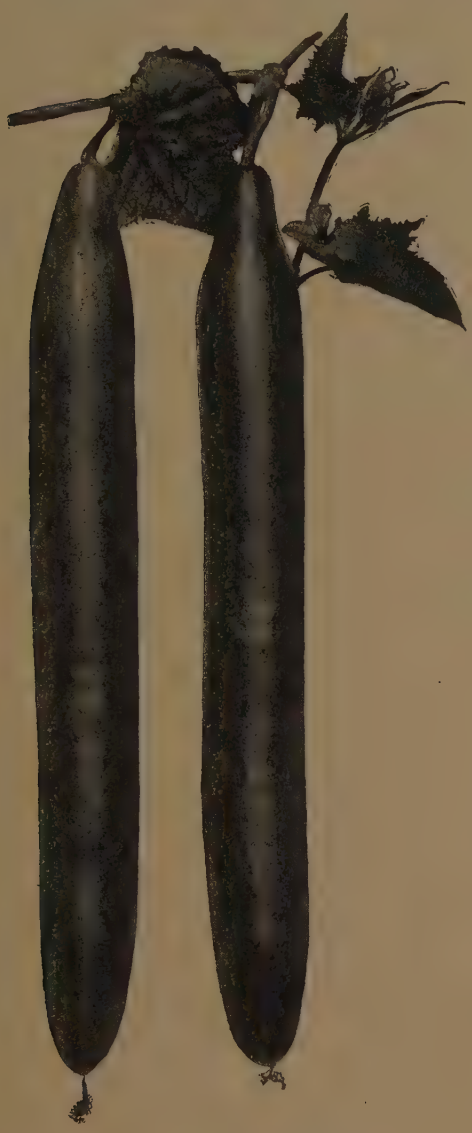

Fig. 92.—Cucumber—Peerless.

LOCKIE'S PERFECTION.—Fruit 12 inches to 15 inches in length, somewhat thick, smooth, perfectly straight, short neck; quality good. Plant fairly robust, and a good cropper. Succeeds well in frames, and is occasionally grown for market.

MATCHLESS (fig. 91).—Fruit 18 inches to 24 inches in length, straight, smooth, thick, dark-green in colour, neck short; quality excellent. Plant robust and very productive. Succeeds well in either house or frame. Fine for exhibition.

MODEL.—Fruit 18 inches to 24 inches long, ribbed, smooth, dark-green in colour, neck short. Strong grower, fairly productive. Good exhibition variety.

PEERLESS (fig. 92).—Fruit about 18 inches long, thick, smooth, dark-green in colour, and of excellent quality, neck short. Strong grower, and a heavy cropper. A handsome variety, and quite distinct.

ROCHFORD'S MARKET.—Fruit 15 inches long, thick, ribbed, with few spines, colour dark-green, and quality superior. Sturdy, short-jointed in growth, and very productive. A great favourite with market-growers, and also one of the best for frame culture.

ROYAL OSBORNE.—Fruit 15 to 20 inches in length, very even, smooth, light-green in colour, and of excellent quality. Tapering neck. Plant short-jointed and productive. Good for exhibition.

TELEGRAPH.—Fruit 15 inches to 18 inches long, thick, slightly ribbed, few spines, colour dark-green; quality excellent. Plant fairly robust and very productive. An old favourite, good for either summer or winter culture.

TENDER AND TRUE.—Fruit 24 inches to 30 inches in length, of medium thickness, few spines, dark-green in colour, and of superior quality. Plant fairly robust and prolific. Another old favourite.

DANDELION (*Taraxacum Dens Leonis*).—This well-known plant, which medicinally is of some importance as an anodyne, aperient, and diuretic, is occasionally blanched and eaten as a salad, both in this country and in France; as such it is much esteemed by many.

It should be sown in spring, in a rather moist soil, previously well dug; or roots may be planted. In the following spring, as soon as the plants begin to push above ground, they may be covered with a layer of sand 3 or 4 inches in thickness, or flower-pots may be placed over them; but blanching by means of sand is preferable. When the leaves begin to make their appearance above the sand a portion of the plants may be cut over by the ground, and by casting the sand which covered them over the uncut portion, the latter will be covered to a greater depth at each cutting, and will consequently come in for use in succession. It is hardly necessary to observe that the plants should not be allowed to scatter their seeds in summer.

EGG-PLANTS, or AUBERGINES (*Solanum Melongena*).—An annual, cultivated in the warmer regions of the globe before the Middle Ages; supposed to have had its origin in India or Arabia. Modern travellers have found it cultivated in the Nile Valley and on the coast of Guinea. The fruits are

highly esteemed in many countries, but they have only recently found favour in the British Islands for table use. They are eaten either raw or cooked, in the same way as Tomatoes. There are many varieties, their colour ranging from white to black-purple, whilst in shape and size they also vary considerably, the largest being from 6 to 8 inches long, and 2 to 3 inches in diameter. One called *ovigerum* has fruits exactly the same shape and colour as a hen's egg; it is often grown in England as a decorative plant; its fruits are not eaten.

In Provence the fruit is cut longitudinally in two, and the seeds and spongy substance surrounding them are taken out. The two halves are then placed on the gridiron, with the cut faces upwards, and whilst roasting the flesh is soaked with fine salad oil or fresh butter, applied a little at a time, a sufficiency of pepper and salt being added. Some augment the flavour with Parsley, Anise, or other aromatic herbs; others place an anchovy or a pilchard between the two pieces. The great difficulty in cooking is to avoid the flavour of smoke; with this object the fruit is sometimes cooked between two plates.

Another mode of preparation consists in peeling the fruit, placing it in a frying-pan, scoring it across and across, filling the incisions with fine Florence oil, and then sprinkling with salt, pepper, nutmeg, and grated bread. When half-cooked a little aromatic vinegar is poured over the fruit, which is then served garnished with Parsley or Chervil.

To obtain well-ripened fruit, seeds should be sown in January or February, in pans of rich soil, and placed in a temperature of from 65° to 70°. When the young plants have made two leaves, they may be set singly in small pots, from which they should be shifted on till in 8- or 10-inch pots, in which they may be fruited. The plants ought at all times to receive abundance of water, and manure-water may be occasionally given until the fruit has nearly attained its full size. They are best when grown with a single stem, which must be pinched to encourage the production branches. When four fruit are set, no more fruit or laterals should be allowed to form, or the fruit will be small.

The Parisian market-gardeners sow the seeds in December or January on a hot-bed the heat of which should be from 65° to 75°, surrounded with a good lining, and covered with a layer of leaf mould about 5 inches thick. The sashes are covered at night with a good straw mat. A fortnight or three weeks after sowing, a second bed, not so hot as the first, is prepared, and when the seed-leaves are well developed the young plants are transferred from the first into this second bed, and after some time they are again taken up and replanted in the same bed, but at the distance of 8 or 9 inches from each other. The covering of the sashes at night is still continued, and as soon as the young plants begin to grow a little air is given if the temperature permits.

In March another hot-bed is prepared. When the heat is from 60° to 68° four egg-plants are planted under each 4½-feet sash. They do not get air for several days, in order that they may more readily take root, after which a little air is given. The sashes may be taken off in the month of May. Fruit fit for gathering may thus be obtained about the end of June or beginning of July, and the plants continue to bear till October.

ENDIVE (*Cichorium Endivia*) (fig. 93).—A hardy annual, common in the Mediterranean region. It is closely related to the common Chicory. In habit it resembles a Cabbage Lettuce, the leaves spreading in a rosette from a short fleshy stem. It requires less warmth than the Lettuce, and is therefore useful as a salad in late autumn and winter. It also serves as an ingredient in other culinary preparations.

Cultivation.—A light rich soil is suitable for the growth of Endives, and a position exposed to full sunshine. A small sowing of seeds may be made in May. The first main crop may be sown about the middle of June. Sowings for winter use should be made in August and September, and from these plants may be lifted at the end of October with good balls and set in frames fairly close together. They should be freely ventilated whenever the weather permits to ensure healthy growth and prevent damping.

The seeds should be sown thinly, on a bed of rich soil raked fine, in shallow drills 6 inches apart, covering lightly. In dry weather the seed-beds should be watered through a fine rose till the plants make their appearance. As they advance in growth they should be thinned out to 3 or 4 inches apart. When they have made four leaves they should be carefully taken up and replanted where they are to remain. Plants of the curled-leaved varieties may be planted 1 foot apart each way; but for the Batavian, which requires more room, 15 inches by 12 inches may be allowed.

Instead of sowing in seed-beds and

transplanting, some sow the seeds where the plants are to remain, and thin out. This answers well for the early crops, or such as have not to be planted on sloping banks, or in frames in winter.

About three months after sowing, or as soon as the plants are nearly full-grown, the leaves should be gathered together, and tied up near the ends with matting, and again round the middle about a week afterwards. If water should be necessary after tying, it should only be given at the roots.

Blanching is also effected by placing inverted flower-pots over the plants, covering the hole in the bottom with a piece of slate or tile; by laying a slate, or preferably a flat tile, over the plants; by covering with sand or coal-ashes; or by placing boards on each side of the row, leaning their upper edges against each other, so as to form a roof, and preventing the light from getting in at the ends. A mat laid over the plants also answers tolerably well for the flat-growing kinds. The best methods, however, are tying up, or using a blanching-pot or saucer.

Forcing.—In France this excellent winter salad is regularly forced, under the following treatment:—

The seeds are sown in January and February on a brisk hot-bed covered with vegetable mould, which is afterwards beaten with the back of the spade to give the seed a hold. A fortnight or three weeks after the plants come up they are transplanted in another hot-bed where less heat is maintained. Air is given when the weather is favourable, and the plants, when sufficiently hearted, are tied up as when grown in the open ground. Endives produced in this way are perfectly blanched, of good flavour, and are sold at Paris in the spring.

There is another mode which has been successfully practised of late years, and in which the seeds are sown from the 10th to the 15th of September, in the open ground, under bell-glasses or cloches, or in a cold frame. About three weeks afterwards the young plants are pricked out under other bell-glasses or in cold frames; and in November or December they are planted close together in frames. The plants must not be exposed to the air, otherwise they toughen; they should therefore be kept rather close; and in frosty weather they must be protected with litter and straw mats. Endives obtained in this way are very small, but well blanched and very good. The French Small Green Curled is the kind generally employed for forcing.

The time occupied in blanching varies

Fig. 93.—Moss-curled Endive ready for blanching.

from ten days to three weeks—a longer period being required for completing the process in winter than in summer, when growth is more rapid. A number of plants, sufficient to afford a supply for a week, should be set to blanch at one time, and by doing the same every week a constant succession will be secured.

Various modes of protecting Endives during the winter are adopted. The market-gardeners near London form sloping banks facing the south and sheltered from the north. On these, in November, Endives

Fig. 94.—Endive in cold frame for winter use.

are planted 6 or 8 inches apart, and protected with litter in severe weather, but they are left uncovered at all other times. A supply during winter may, however, be more certainly secured by taking up the late-sown crops before frost, and replanting in soil or sand in a frame or shed, or by placing a frame over them without taking up. These can be blanched by one of the methods already given, or in a Mushroom-house. To keep the plants clean during the process of shifting they should be tied up with matting strips. Blanched Endives soon lose their freshness.

To save Seeds.—Only the finest plants should be selected, preferably autumn-sown that have been protected through the winter and planted out in a warm sheltered situation in March, or plants raised from seed sown early in spring. The flower-stems should be supported, to prevent injury from the wind, and the seeds should be gathered as they ripen. After having been spread upon a cloth to dry, they may be rubbed out and stored. They remain good for five or six years. Plants raised from old seeds are not so apt to run as those from new seeds.

Broad-leaved Batavian (fig. 95).—Leaves long and broad, the edges somewhat ragged. Commonly cultivated. Requires to be tied up for blanching.

Exquisite Curled.—It would be difficult to convey an idea of the beauty of this elegantly curled Endive. In colour it is midway between the white and green varieties, and in habit it resembles Fine Green Curled. Recommended for forcing.

Fine Green Curled.—The finely-laciniated leaves are highly ornamental, and make a most delicate salad. If sown in a shady position the plants remain fit for use a long time.

Incomparable Green Curled.—Not so finely curled as some other varieties, but one of the largest, and produces beautiful white crisp hearts. Does not readily run to seed.

ITALIAN GREEN CURLED.—Leaves narrow, divided to the very midrib, segments also much cut and curled; whole plant dark-green. Ties up well.

LARGE GREEN CURLED.—Leaves longer and rather more upright than those of the Small Green Curled. It ties up well to blanch, is hardy, and is not subject to rot.

Fig. 95.—Endive—Broad-leaved Batavian.

LETTUCE-LEAVED BATAVIAN.—Leaves large, obtuse, ragged at the edges, of a pale colour even when young. They require to be tied up for blanching. Should only be cultivated for early use, as it is tender.

MOSS.—A small, very finely-cut and curled sort, allied to Stag's-horn.

SMALL BATAVIAN.—Leaves pale-green, slightly ragged at the edges, forming a good heart; mild and sweet compared with others.

SMALL GREEN CURLED.—Leaves much cut and curled, lying flat on the ground; heart-leaves full and close. It is slow in hearting, and when sown early is apt to run.

STAG'S-HORN.—Leaves deep-green, finely cut, but not much curled; heart full, yellow, and tender. One of the principal kinds grown for the Paris markets.

WHITE CURLED.—Leaves flat on the ground, with a very open heart, pale-yellowish. Is best when cut very young for salads.

WINTER CURLED.—A large hardy, curled Endive, admirably adapted for winter use.

FENNEL (*Fœniculum vulgare*), a perennial, native of South Europe, naturalized in this country. Its tall, finely-divided, aromatic leaves are used in fish-sauces and for garnishing, the stalks are eaten in salads, and the seeds are employed in confectionery and for flavouring liqueurs.

The two varieties cultivated are the common or Sweet and Finochio Fennel (fig. 96).

The common Fennel may be propagated by sowing the seeds in February, March, or April, on a light warm soil, in shallow drills 15 inches apart, thinning out the young plants to 1 foot apart; or the seeds may be sown in a bed, and the seedlings planted out when 3 or 4 inches high. With the ordinary culture of keeping the ground free of weeds, and stirring it occasionally, a plantation will last several years. If seeds are not to be saved, the plants should be topped, with the view of encouraging a growth of young and tender leaves, and to prevent the production of seeds, which, if allowed to ripen, would scatter, and seedlings would spring up in all directions.

Finochio Fennel is seldom grown in this country, but in Italy it is much esteemed for its swollen leaf-stalks, which are shorter and rounder than in Celery, and which are blanched and eaten raw with pepper and salt; or boiled with fowl, meat, Parmesan cheese, or macaroni. Finochio requires a rich soil, and should be sown in drills 1 foot apart, thinning out, when the young plants are well established, to 8 inches in the row. The ground should be stirred and frequently watered, in order that they may grow rapidly; they should be earthed up about three weeks before they are to be used.

A sowing should be made about the middle or end of March, according to the season; and monthly from that time till the end of July or beginning of August, if a constant succession is required. The plants from the first sowing will be fit for use in July, and the others will come in for use in succession till December. At the approach of frost, the plants should be protected with fern or litter.

Fig. 96.—Finochio Fennel.

GARLIC (*Allium sativum*).—A hardy perennial, native of South Europe. It is cultivated for its bulbs (fig. 97), which are

used in soups, stews, and other ways; but not so much in Britain as in Italy, Spain, Germany, and the south of France—its strong flavour, and the offensive smell which it communicates to the breath, causing it to be sparingly used in our cookery.

Garlic succeeds best in a light, rich, and rather dry soil, and a warm situation. It is propagated by bulblets, planted in February or March, 6 inches apart, in shallow drills 1 foot asunder, and covered to the depth of 2 inches.

A small quantity may also be planted in October or November, to come in earlier than the spring planting. All the culture

Fig. 97.—Garlic.

necessary is confined to keeping the ground free of weeds. When the leaves turn yellow, the plants may be taken up, dried in the sun, and then tied in bunches by the stalks, and hung in a dry airy room. Some bulbs from the autumn planting may be taken up in May or June for immediate use.

GOOD KING HENRY (*Chenopodium Bonus Henricus*).—A perennial, native of Europe, including Britain.

Certainly an excellent vegetable, and deserving to be more generally planted. It is extensively grown by the Lincolnshire farmers, almost every garden having its bed, which, if placed in a warm corner and well manured, yields an abundant supply of delicious shoots a fortnight before Asparagus comes in, and for some weeks afterwards. From a south border, cutting generally commences early in April, and continues till the end of June. Some prefer it to Asparagus.

When properly grown, the young shoots should be almost as thick as the little finger, and in gathering it should be cut under the ground, something the same as Asparagus. In preparing it for use, if the outer skin or bark has become tough, strip it off from the bottom upwards, and then wash and tie it up in bunches like Asparagus. It is best boiled in plenty of water. When tender, strain and serve alone, or upon toast, or with melted butter, or with gravy and meat.

Cultivation.—Sow the seeds in spring in a seed-bed and transplant into rich deep soil, in rows 18 inches apart each way. The treatment should be generous in regard to manure and water.

GOURDS, SQUASHES, or **PUMPKINS** (fig. 98).—These are popular names for a large number of species and varieties of plants belonging to the Cucumber family. They are tender or half-hardy annuals, natives of the warm parts of both hemispheres, and cultivated in most tropical and sub-tropical countries. Many of them are hardier than the Cucumber and the Melon, and succeed very well in the open ground in ordinary summers in the southern parts of Britain.

They cross readily with each other, so that it is difficult to keep any one distinct if other sorts are growing in the neighbourhood and flowering at the same time.

The best known of the hardier sorts of Gourd belong to the following:—

Cucurbita Maxima, with stout unfurrowed stalks, leaves broader than long, with rounded lobes. To this belong the Large Yellow, Ohio, and Turk's Cap Gourds, also the common Pumpkin.

C. Pepo, with slender deeply-furrowed stalks, leaves deeply lobed, hairs very stiff. This comprises the Vegetable Marrows, the Custard Marrows, the Crook-neck, and the little Orange and Egg Gourds.

C. Moschata.—Stalks slightly furrowed and much enlarged near the fruit; leaves deeply lobed, scented, often marbled; seeds rough. To this belongs the Naples, or Carpet-bag, and Yokohama Gourds. All the varieties of this require a warm climate to come to perfection.

All the sorts require the same treatment as the Vegetable Marrow. The seeds should be sown in heat, in April, and forwarded under glass; but after the plants are above-ground they should only be kept in very gentle heat. They must be shifted into larger pots, as may be necessary, and kept growing moderately, gradually exposing them to the open air previous to planting out, which should be done when the weather becomes sufficiently mild in May or June,

according to season and climate. If heat is not at command, the seeds may be sown early in May in pots under a hand-glass; or, after the middle of May, they may be sown in the open ground.

The following are some of the sorts best deserving of cultivation :—

CANADA CROOK-NECK.—Without doubt far superior to any other for the late or main crop. It is fine-grained, mealy, and of a sweet excellent flavour. By being kept in a dry and suitable temperature [not below 38°] the fruit may be preserved till the following summer.

CROOK-NECK (Early Bush).—Much cultivated in America, and esteemed the best sort for summer. It is a bush variety, very early and productive. Fruit crooked-necked, with numerous warty excrescences on the surface; colour bright-yellow; shell very hard when ripe. As it does not run, it may be planted 3 feet apart.

CROWN GOURD (Bonnet or Scollop Gourd, Pattypan of the Americans).—The plant forms a round bush, and does not run. The fruit, which is produced very close to the stem, is flat and scolloped on the edge. In America two sub-varieties, Early Yellow and Early White, are cultivated, and used when young and tender for boiling as a vegetable, and at maturity for making pies.

EGG, APPLE, and ORANGE GOURDS.—In size, form, and colour these resemble the objects after which they are named. Trained on a pole, they are very ornamental. The fruits may be used in a young state, but in quality they are not equal to the Vegetable Marrow.

EGG-SHAPED GOURD (Reeves' Gourd).—Fruit weighing from 15 to 20 lbs., but may be grown to upwards of 50 lbs.; thick, ovate, sometimes tapering abruptly. Skin or shell hard, of a reddish colour. Flesh firm, red, excellent when ripe and cooked as a vegetable, or in any other way in which Gourds are prepared. The stems run to a very great length, and bear most abundantly.

GREEN-STRIPED BERGEN.—A bush variety of strong growth, requiring to be planted 4 feet apart. Fruit small, bell-shaped, striped with dark-green and white. It is used both in the young and ripe state. It is cultivated to a considerable extent for the New York market; and, although it is not so productive as some, yet it is said to be comparatively hardy, ripening well even in the coldest seasons.

HARRISON'S PUMPKIN is a very productive variety of the preceding, according to Kenrick, who states that it has produced upwards of 50,000 lbs. of fruit per acre.

ITALIAN VEGETABLE MARROW.—This forms a dwarf bush with short reclining stems and upright leaves, which are deeply five-lobed. The fruits are used when the flowers are about to drop from their ends; they are then from 4 to 5 inches long, and 1½ to 2½ inches in diameter. When ripe, the fruit is from 15 to 18 inches in length, and about 6 inches in diameter. It is pale-yellow, striped with dark-green. It should, however, be used in the young green state, for when mature it is not so good as many of the other Gourds. It bears very abundantly, and as it does not run, may be grown in smaller compass than the true Vegetable Marrow.

MAMMOTH PUMPKIN (Large Yellow Gourd, American Gourd).—This is the largest-fruited variety known. In a very rich compost above a large quantity of manure, and under favourable conditions of climate, it grows to an enormous size; fruit weighing 120 lbs. is by no means uncommon. In America it has weighed 226 lbs.; and at Sutcombe, in Devonshire, one weighing 245 lbs. was produced. This, we believe, is

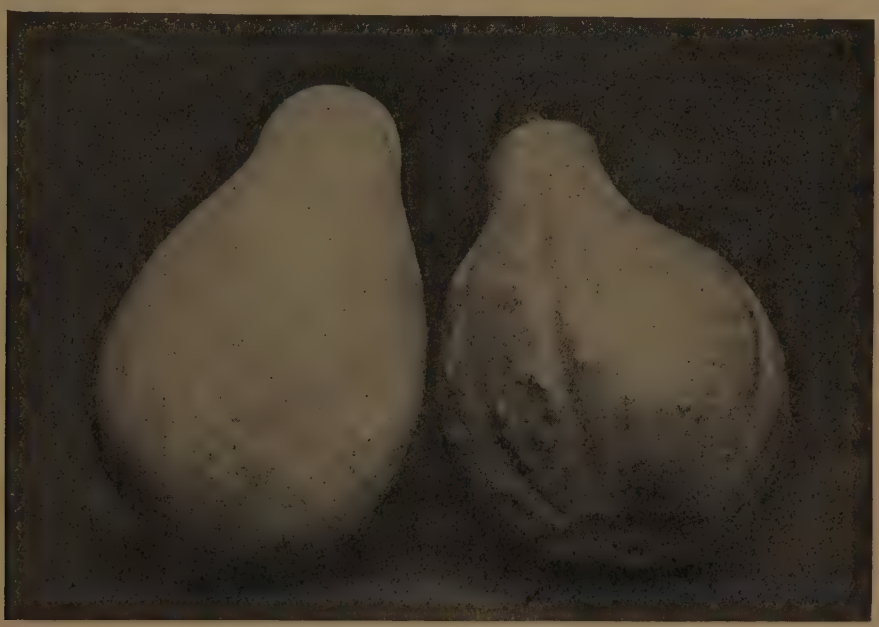

Fig. 98.—Pear-shaped Gourds.

the heaviest fruit on record. The leaves are very large, and the stems thick, running along the ground to the distance of 20 or 30 feet if not stopped, and readily striking root at the joints. The fruit is round or oblate, sometimes flattened on the under side owing to its great weight, sometimes obtusely ribbed, yellowish, or pale-buff, frequently covered to a considerable extent with a grey netting. Flesh very deep yellow. It is only used in a full-grown or ripe state, in which it will keep for several months, and even during the winter, if preserved in a dry airy place, where it may be suspended in a strong net. The flesh is used in soups and stews, mashed, or baked in pies.

SPANISH GOURD.—Fruit of medium size, very flat; skin smooth and hard, usually green. Flesh firm, and of excellent flavour.

TURK'S CAP (Turban Pumpkin).—Fruit of medium size, flat, with a rounded margin and elevated centre, which is deep-green; the rest is yellow or pale-green. Flesh firm. Chiefly grown for ornament in this country.

VEGETABLE MARROW.—See p. 183.

WINTER CROOK-NECK.—The kind most generally cultivated in New England for autumn and winter use. Fruit long, curved, and solid, of a pale-yellow; but the deeper the colour the better. An abundant bearer, excellent for pies. Being a runner, it should be planted 6 feet apart.

HOP (*Humulus Lupulus*).—A perennial, native of this country. The use of its flowers in brewing is well known. In gardens it is principally grown as a screen to hide unsightly objects. Its young shoots, cut when about 4 inches above ground, are occasionally used in spring instead of Asparagus. Male and female flowers are borne on separate plants, the female being the one cultivated in plantations. Several varieties are distinguished by Hop-growers.

The Hop prefers a rich deep loam, deeply dug, and manured if necessary. It is propagated by division in spring or autumn, or by cuttings of the shoots of the preceding year taken off from the crown of the plant in March. If the plants are intended for the production of tops, they may be planted a foot apart, in rows 3 feet asunder; or in a single row near any object which it may be desirable to screen. Poles or sticks should be placed for them to climb upon, and the ground should be kept free of weeds, and stirred in spring and autumn.

HORSE-RADISH (*Cochlearia Armoracia*) (fig. 99).—A hardy perennial, naturalized in Britain. It is cultivated for its stout, long, cylindric root-stocks, the use of which, after being scraped into shreds, along with roast beef, or grated with soups, is well known. It is antiscorbutic, and therefore important for a maritime nation, for the roots may be kept during a long voyage by merely burying them in sand.

It grows almost anywhere; but the best and most tender roots are produced in a deep, rich, and rather moist soil; a sandy loam sufficiently moist is suited for its growth, and it succeeds well in rich sandy

Fig. 99.—Cuttings of Horse-Radish prepared for planting.

alluvial soil. It is propagated by planting pieces of the roots, any portion of which will grow even if deeply buried in the earth. It should be planted in rows 2 feet apart.

To maintain a constant supply of Horse-Radish the beds should be trenched and replanted annually, lifting half the crop each year about Christmas time if the weather permits, selecting the best roots, which may be stored away for use as required, using the small roots for replanting.

In trenching the ground it is advisable to work in plenty of wood ashes, sand, or other lightening material, also a good dressing of well-decayed manure dug into the bottom. Planting may be done as soon as the ground is in a suitable condition, selecting straight pieces with one crown, and these should be buried to a depth of 6 inches.

Large quantities of Horse-Radish are imported from Holland, where the soil is favourable for producing it; but that grown by the market-gardeners near London fetches a higher price.

INDIAN CORN, or MAIZE (*Zea Mays*) (fig. 100).—Cultivated in all quarters of the world—Europe, Asia, Africa, America, and Australia—but to a less extent in Europe than in any of the others. As a cereal its ripening cannot be depended on in all seasons even in the south of England when sown in the open ground, and its culture,

Fig. 100.—Cob of Indian Corn (*Zea Mays*).

consequently, has never taken a hold in this country; but raised in heat, and afterwards planted out, the crop ripened well for several years in succession at Chiswick. Attention has recently been directed to it from another point of view—as a table vegetable. In America the cobs are taken as soon as the grains are plump, and boiled for about half-an-hour, more or less according to their age. Thus cooked, and eaten with salt and butter, they are highly esteemed, being considered fully equal to Peas. There is, however, nothing new in the cultivation of Maize being recommended for this purpose, for the celebrated William Cobbett in his *English Gardener*, published in 1829, wrote of it: "This is a very fine garden vegetable. The ear (cob) is stripped off the stalk just at the time when the grains are full of milk. The ears are then boiled for about twenty minutes: they are brought to table whole; each person takes an ear, rubs over it a little butter and sprinkles it with a little salt, and bites the grains from the stalk to which they are attached, and which, in America, is called the cob. In the Indian Corn countries, every creature likes Indian Corn better than any other vegetable, not excepting even the fine fruits of those countries." Cobbett also recommended it as a field crop. "Several of the sorts will seldom ripen well with the heat which they get in the state of New York, requiring that of Carolina or Virginia at least. Other sorts will ripen perfectly well as far north as Boston; and there is a dwarf sort which will ripen equally on land 500 miles to the north of the last-mentioned place. Whether this be the same sort as that which I cultivate I do not exactly know, but mine never fails to come to perfection in England, be the summer what it may." There are now in this country varieties which are doubtless much superior to that which Cobbett grew, some of the best of which are: Adam's Early, Crosby's Early Sugar, Country Gentleman, Early Dwarf Sugar, Early Metropolitan, Early Minnesota, Extra Early Tom Thumb, Moore's Early Concord, and Triumphant Sweet.

The culture of Indian Corn is very simple. The seeds should be sown in boxes thinly during the middle of April in gentle heat, afterwards hardening off before the seedlings are transferred to their permanent quarters, which should be done about the end of May. The ground for this crop should be warm and sunny, and sheltered from north-east winds. It should be well manured some time previously; the distance allowed should be 3 feet between the rows and 2 feet between the plants. The plants should always in their young growth have a fair supply of water and be staked.

JERUSALEM ARTICHOKE. *See* SUN-ROOT.

KIDNEY- or HARICOT-BEAN (*Phaseolus vulgaris*).—The Kidney-Bean, or French Bean, is a tender annual, a native of South America according to De Candolle: "It has not been long cultivated in India, south-west Asia, and Egypt; it is not certain that it was known in Europe before the discovery of America; at this epoch the number of varieties suddenly increased in European

gardens." It was introduced into Great Britain in 1509 from the Netherlands, and the first variety grown was White Dutch. Great improvements have been made by the breeding of varieties for forcing, frame, and outside culture, and these vary considerably in size and quantity of pods produced. They are known as tall or dwarf sorts. The green sorts are much stronger than the coloured ones.

There are two well-marked varieties, namely, the tough-podded, the pods of which are tough and leathery when ripe, and the edible-podded, the pods of which never become stringy, and are therefore useful as a vegetable when mature. These are again divided into tall or climbing sorts and dwarf sorts. They differ from the Scarlet-Runner Bean (*P. multiflorus*) and the Lima Bean (*P. lunatus*).

The Kidney-Bean is an important and excellent vegetable, affording a large amount of produce from a small space. When the weather is sufficiently warm it soon yields a supply, and continues to do so in succession for a long time. If the green pods are superabundant in summer, they may be preserved in salt for use in winter; they may be made into a pickle alone, or together with other vegetables; and, finally, the ripe seeds can be used in a variety of ways—in haricots, soups, and stews.

Cultivation.—Originally from the warm parts of the world, the Kidney-Bean requires a warm soil and situation. For early crops, more especially, a rich sandy loam is desirable, and as warm a situation as can be afforded, such as the border in front of a south wall, or along the bottom of a wooden fence, but at the same time exposed to the sun. For the main crops, however, any well-conditioned garden soil will answer. For the latest crops a light warm soil and a good situation, similar to that for early crops, should again be chosen. In the northern parts of the kingdom it may, in some cases, be advisable to depend chiefly for a supply on the dwarf sorts grown on a south border, or on the flat ridges between early-dug Celery trenches—a position that suits this class of Bean admirably.

No manure is required where the soil has been manured for the previous crop; but where the soil is not rich, half-rotted stable-dung is good for the early-sown crop, and for this a compost of light hot-bed dung and leaf-mould, the whole in a state that will readily permit the passage of water, may be put into the drills, made deeper than usual for the purpose of receiving it. This will afford nourishment to the plants, and will act as drainage. A mixture of leaf-mould, or decomposed dung and dry fibrous turf, will have a similar beneficial effect. For the main crop well-rotted manure is preferable, unless the soil is rather strong and damp, and in this case horse-dung partially decomposed may be used.

Sowing.—The principal sowing for the main crop should be made in the first week in May. The earliest may be made in the beginning of April, and the latest in July. These, and a few intermediate sowings, will suffice to produce a constant supply during the time that Kidney-Beans can be expected from the open ground.

Where there is no opportunity of forcing Kidney-Beans, it is desirable to use every available means to procure them from the open ground as early as possible. It is therefore advisable to sow early in April in small pots, in moderate heat, and to keep the plants well sheltered at night till they can be transplanted out-of-doors; or they may be planted in frames 24 inches between the rows and 12 inches from plant to plant, and if likely to become too tall before the weather admits of their being planted out, they may be topped once or twice; or they may be placed in pots close to the bottom of a wall, and afterwards planted out in rows across the border. For the earliest out-of-door crops it is easy to protect the plants from frost, and the soil from being chilled, by means of neatly-made well-thatched hurdles, placed sloping on bearers supported by posts.

When the ground is prepared, drills should be drawn so as to admit of the seeds being covered 1 to 1½ inch deep. The direction of the drills for the early crop on a border in front of a south-aspect wall may be oblique from north-west to south-east. By this arrangement the sun's rays, when hottest, will fall almost perpendicularly, and consequently with the greatest effect, on the sides of the ridges formed by earthing up the plants, the rooting of which will be encouraged by the soil being thus heated. The distance between the rows should be about 2 feet. Where the soil is not very rich, some of the dwarfest sorts may be in rows only 18 inches apart, and the plants from 9 to 12 inches from each other in the row.

The subsequent cultivation consists in watering when needful, stirring the soil, and earthing up. The latter operation is not absolutely necessary, yet in wet seasons, and in cold soils, it is of considerable utility, for

it has been observed that when the lower fibres of the root have mostly perished from much wet, fresh fibres have pushed from the stem in the upper part of the ridge. The climbers should be staked like Peas, if sticks can be cheaply and easily obtained; but if not, the running tops should be pinched off when the plants are from 1½ to 2 feet high.

Gathering the Crop.—In some cases the pods are required when small and young, in others they are allowed to grow larger; but in any case they ought to be gathered

Fig. 101.—Kidney-Bean—Waxpod.

whilst they are so crisp as to readily snap when bent. When the seeds are to be used in the dry state, the crops should be only gathered when the pods are quite dried up. In gathering for use in the state of green pods, none should be left that are getting too old. If they are removed, new ones will continue to be formed in great abundance; whereas, if allowed to remain till the seeds approach maturity, the formation of young pods is, in a great measure, prevented.

To save Seeds.—The best seeds are produced from plants sown at the earliest season that their growth can proceed without a check, and this is generally the case with the May sowing. The first-formed pods should be reserved, except some of the smallest, which may be thinned out. After a considerable number of pods have been thus reserved on each plant it will be advisable to gather, in a young state, all that may be subsequently produced. By these means plump and well-matured seeds will be obtained.

Forcing.—Kidney-Beans may be grown in pots in any forcing-house in which they can be duly exposed to light. Where the temperature can be properly regulated, a minimum of 60°, and a maximum of 75°, or 80° by sun-heat, will be found most suitable. The bottom-heat ought at least to correspond with the mean temperature of the house. Early dwarf sorts, such as Early Favourite, Ne Plus Ultra, Sion House, Osborn's Forcing, with Canadian Wonder for the later supplies, should be used for forcing.

The seeds should be sown in 8-inch pots three parts filled with light, turfy loam and leaf-mould or decomposed cow-dung, placing from five to seven new seeds in each pot, and covering with 1½ inch of soil. New seeds germinate quicker and stronger than old seeds. Before the plants crowd, thin to three to five in a pot for a quick crop, and to three in a pot for a more continuous one. The old-fashioned plan of allowing room for and giving top-dressings has nothing to recommend it—is so much wasted labour, in fact. Support the plants either with birch or hazel spray, or by means of sticks and strips of raffia. During April and May deep narrow boxes should be substituted for pots, as being the least affected by strong sunshine, and the plants they support are, as a consequence, less liable to be spoilt by red spider.

Kidney-Beans do well when planted in heated pits or in frames on hot-beds in succession to early Potatoes in May and June, or when the houses are too hot for pot culture. Avoid overcrowding. The rows should run from the back to the front of the lights, and be fully 24 inches apart. The plants must not be allowed to get too dry, or red spider will be encouraged. They should be well syringed till they come into flower. It is impossible to thoroughly moisten the under side of the leaves by syringing; but if this is done by syringing early in the morning, and the house kept shut up for a little while, a saturated atmosphere will do the work as thoroughly as if the plants were completely immersed in

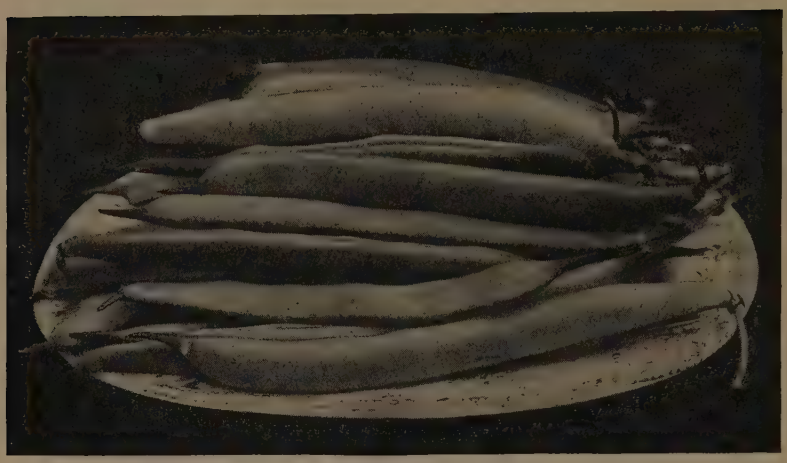

Fig. 102.—Kidney-Bean—Ne Plus Ultra.

water. This is a great help against the attacks of red spider. Give plenty of air when the plants are in flower, and feed regularly with liquid manure. Kidney-Beans fit for use may be obtained by forcing in six weeks or two months from the time of sowing. Some seeds, therefore, may be sown in August to succeed the crops in the open ground; and for succession, other sowings may be made every month or so till the following March.

Dwarf Sorts.

CANADIAN WONDER.—A strong grower and heavy cropper, 15 to 18 inches high; pods long, straight, and tender; seeds red-purple. A very popular Bean.

CUTBUSH'S GIANT DWARF.—A robust-growing variety, and a great and heavy bearer; adapted for the second early or main crop; the pods are very long, thick, fleshy, and handsome; seed long, crimson.

DWARF BUTTER.—A vigorous bushy variety, about 2 feet high, and a great bearer; pods 3 to 4 inches long, thick and fleshy, of a pale-lemon colour, which they assume when quite young and retain throughout; they are very tender when cooked and of excellent quality. The seed is black.

SUTTON'S FORCING.—A remarkably dwarf and prolific Bean, producing an excellent crop in a very short time from the date the seed is sown; pods long, slender, excellent when green.

EVERBEARING.—An early variety for forcing or general use, producing an immense crop of pods from 7 to 9 inches long, and of superior quality. Plants sturdy, a continuous flowerer. Ripe seeds white, useful as a Haricot.

EARLY MOHAWK (Early Six Weeks).—About 15 inches high. A very productive variety, much esteemed in America on account of its being very early and hardier than many others.

CARTER'S SUNRISE.—A superb and distinct variety, a heavy cropper and excellent flavour; very compact in growth and remarkably early.

LONG-PODDED NEGRO (Black Canterbury).—Grows about 15 inches high, producing broad luxuriant foliage. Pods long, of uniform breadth, and very succulent. In rich soil the plants should be topped, and restricted to a foot in height.

MAGNUM BONUM.—A distinct Dwarf Bean

Fig. 103.—Kidney-Bean—Sutton's Masterpiece.

with long elegant pods, produced with even greater freedom than Canadian Wonder.

CARTER'S MAGPIE.—One of the most productive, and of splendid quality; an excellent forcer.

NE PLUS ULTRA (fig. 102).—Stems about 1 foot high; early and productive; tender when young; pods of medium length, crisp; seeds brown.

OSBORN'S EARLY FORCING.—An excellent dwarf and early variety of very productive habit. The mature seed is dark-brown speckled.

PLENTIFUL.—Pods long, freely produced, and practically stringless. One of the earliest croppers. The pods are fit to gather in about ten weeks from the time of sowing on a sunny border.

SION HOUSE.—From 12 to 14 inches high; pods long, crisp, and tender. An abundant bearer, and an excellent forcing variety; pods frequently tinged with purple.

SUTTON'S MASTERPIECE (fig. 103).—Plant robust, very prolific; pods stringless, straight, very tender and of good flavour. Foliage persistent and green. Recommended for forcing and for the open ground.

SUTTON'S PERFECTION.—Pods stringless, extremely fleshy and succulent, almost round. The plant has a branching habit, which prolongs the time of bearing, and the long handsome pods are produced in great profusion.

SUTTON'S GOLDEN WAXPOD.—A variety of the Dwarf Waxpod or Butter Bean; a heavy cropper and of good quality.

YELLOW CANADIAN.—About 15 inches high; early. Pods very tender and excellent.

Runner Sorts.

EARLIEST OF ALL.—A Runner Bean with exceedingly fleshy pods, succulent and almost stringless. Young pods 3 inches in length, and cooked whole, possess a delicacy of flavour far superior to older pods sliced in the ordinary manner.

EPICURE.—A climbing Bean, producing pods in great bunches from bottom to top of the vines. The pods are very thick, fleshy, almost round, and when fit for use the seeds are scarcely visible. The crop comes in early, and by successional sowings the plants will bear freely until late in the season.

EXCELSIOR.—The plants run very freely often attaining the height of 10 feet, and are covered with clusters of handsome pods. Apart from its great value for table use this variety has proved a boon to exhibitors.

HARICOT LENTILLE.—Height 5 to 6 feet; pods rather thin-sided, and the seeds become soon prominent; therefore its cultivation for use in a green state is not to be recommended. The dry seeds, however, are of excellent quality, and on this account they are much cultivated near Paris.

PRINCESS OF WALES.—One of the earliest, and of strong climbing habit. Is extremely fruitful and continues in bearing for a long period. Pods long, straight, tender, and delicious. Seed white.

TENDER AND TRUE.—Produces long, straight, pods as early as Canadian Wonder. To assist the plants in climbing freely the sticks should be placed much closer together than for ordinary Runner Beans. VEITCH'S CLIMBING appears to be the same as this.

KOHL RABI or **TURNIP CABBAGE** (*Brassica oleracea caulo-rapa*) (fig. 104).—This holds a place intermediate between the Cabbage and the Turnip, the upper part of the stem swelling into a round fleshy Turnip-like head. It must not be confounded with the Turnip-rooted Cabbage, or *Chou-navet* of the French, the root of which is tuberous.

Fig. 104.—Kohl Rabi.

Kohl Rabi is exceedingly hardy, withstanding even severe frost. It also resists drought better than the Turnip; but in every other respect it is inferior to that vegetable. Much cultivated in Germany, and is becoming more cultivated in British gardens as it may be used where Turnips cannot be produced.

The Early White and Early Purple are by far the best for table use; and when taken young, and properly dressed, they form an excellent substitute for Turnips, especially in dry seasons, when a crop of the latter may fail or be of inferior quality.

Seeds may be sown thinly in drills 4

inches apart, in April, May, June, and July. When the young plants are an inch or two in height, they may be transplanted into any good, well-manured piece of ground, planting them 8 inches apart, in rows 15 inches asunder, and not deeper in the ground than they were in the seed-bed. Water should be given till they take fresh root, and subsequently in dry weather, as required; for though the plant suffers little from drought, yet the tenderness of the produce is greatly impaired by an insufficient supply of moisture.

The crop will be fit for use when the stems are of the size of a cricket ball; when larger they are tough, and only fit for cattle. In the varieties grown in the fields the bulbs sometimes attain an immense size, weighing in some cases as much as 14 lbs.

LAMB'S LETTUCE. See CORN SALAD.

LAVENDER (*Lavandula Spica*).—An aromatic under-shrub, native of South Europe. It is cultivated in almost every garden for its flowers, which are dried and put into wardrobes. They yield, on distillation, the highly esteemed perfume lavender-water; and for this purpose it is grown on a large scale in the neighbourhood of Mitcham, in Surrey.

Lavender succeeds best in a light, warm, and dry soil; in such also it resists frost better, and is more aromatic than when planted in a rich moist one. It may be raised from seeds sown in spring; but the universal method of propagating it is by slips, taken off if possible with roots in March, April, or September.

LEEK (*Allium Porrum*) (fig. 105).—A hardy biennial, said to be a native of Switzerland. It was cultivated in this country prior to 1562.

In the last few years great interest has been taken in the cultivation of Leeks in the Midlands and south of England, though cultivators in these parts do not meet with great success. In the north of England and Scotland the Leek is very successfully grown. For the principal crop, seeds should be sown about the middle of March, and again for succession in the end of April. They should be sown in drills 6 inches apart and afterwards transplanted in rows 15 inches apart and 12 inches asunder; or they may be sown in drills where they are to remain. With the exception of thinning where too close, watering in dry weather and keeping the ground free from weeds, nothing further is required till the young plants are fit for transplanting: those of the late crop may be planted out in August. If extra fine leeks are wanted for exhibition, the seed should be sown towards the middle of January in shallow boxes, pricking them off into boxes as soon as they are large enough to handle in a compost of fibrous loam, rotted manure,

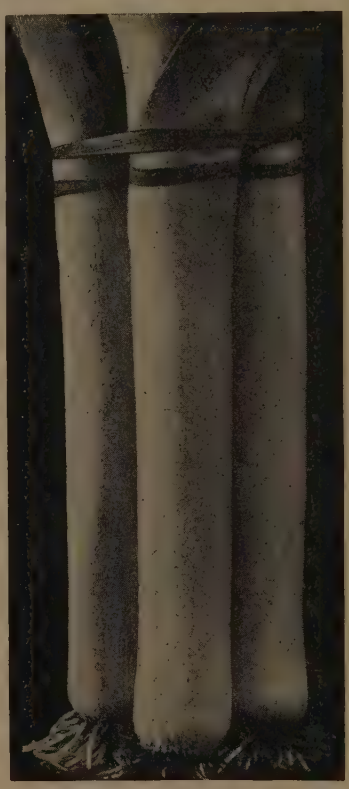

Fig. 105.—Leek—Prizetaker.

and leaf-soil, and kept in a temperature of about 55°, gradually hardening them off before planting them out about the middle of April.

They may be planted in double or single rows as for Celery, allowing 15 inches between the plants and 12 inches between the double rows. To blanch the stem, bandages or collars of brown paper are put on at the time of planting, and as growth proceeds the collars are drawn up and fine soil added. Keep them well supplied with water and liquid manure, especially in the growing season.

For general purposes holes about 3 inches in diameter and 8 inches deep may be made with a dibber, and in these the plant should be placed upright, watering them and allowing little more earth to fall in than is

sufficient to cover the roots. As the plants grow and with hoeing the ground, the holes will become filled up and the blanching proceed.

Another plan is to take out a trench from 9 inches to a foot wide along one side of the quarter, placing the soil where it will be required to fill up the last opening. Dig over and level about 1 foot wide from the side; then at 9 inches from the latter stretch the line, cut down perpendicularly by it with the spade, and bring back the 3 inches towards the undug ground, then plant the Leeks against the perpendicular cut made by the line in the newly-dug ground, spreading their roots, and placing them as low as can be done without burying the hearts of the plants when the soil is made level. The ground can even be lowered after planting the row, so as not to cover the green part of the bases of the leaves, or at most but very little of them.

Another method is to plant them 9 inches apart, in rows from 12 to 18 inches asunder, according to the richness of the soil and the variety. Water should be given at planting, and moderately afterwards. With the exception of loosening the soil with the hoe, and drawing it to the stems, where that method is adopted, nothing further is required. In September the Leeks will be fit for use, and will continue so throughout the winter and spring—those of the late sowing till the end of April. Any then remaining may be taken up and planted close together, but not touching each other, in deep trenches, in a cool situation, in order to prevent them from running to stalk. With the same object the roots may be cut off, and the Leeks kept in a cool cellar.

In order to obtain seeds, some of the largest and most vigorous plants should be taken up in March and planted in a warm sheltered situation. The seeds ripen in autumn, the heads changing to a brown colour. They keep best in the heads, and these should be cut off with a portion of the stalk a foot long, tied in bunches, and hung up in a dry airy shed. In this way the seeds will retain their vegetative power for two or three years; after that time they are not to be depended on.

The best varieties are :—

Ayton Castle Giant.—Leaves moderately broad; stem long and stout, blanching well.

Holborn Model.—Stem remarkably solid, of the clearest white colour, excellent for exhibition and for general purposes.

London Flag.—Tall, with a thick stem; leaves broad; generally cultivated.

Musselburgh (Scotch Flag).—Very large and hardy; leaves broad and tall; stems long and thick.

Prizetaker (fig. 105).—Stems of this have been grown a foot long and 5 inches in diameter. They are solid, pure white, and of mild agreeable flavour.

The Lyon.—One of the largest and most popular for exhibition. Blanches well, and is of mild flavour.

LENTIL (*Ervum Lens*) (fig. 106).—An annual, native of South Europe. Largely

Fig. 106.—Lentil.

cultivated near Paris, both in fields and gardens, for the seeds, which are much used in cookery. It is one of the most nutritious of the pulses; and if good, freed from the outer skin, and cooked till soft, is a good remedy for indigestion. Revalenta arabica is, or should be, made from the meal of the seeds. Prefers a light, warm, open soil; if planted in one that is rich it grows vigorously, but produces only a small quantity of seeds. It should be sown in March or early in April, in drills 20 inches asunder.

When the stems begin to turn yellow, and the pods assume a darker colour, the plants are pulled up, dried in the sun for two or three days, and then placed under cover.

Lentils keep best in the husk; in this way they remain fit for food or for sowing for two years.

LETTUCE (*Lactuca sativa*).—A hardy annual, native of India or Central Asia. It has been cultivated in this country since the middle of the sixteenth century.

To obtain good Lettuces in the early part of summer preparation should be made late in July or early August. An open space sheltered from the north and north-east, and having a hard surface, should be selected, and the dimensions of a one-, two-, or three-light frame, according to the supply required, should be traced out. One thousand plants, fit for planting out, may be reared in each light; but allowance should be made for accidents. The frame should either face the south-east, south, or south-west. The bed should consist of stable-litter, shaken and beaten with the fork, so as to be as equally compact as possible. It should be about 2 feet high at the back and not more than 1 foot in front, for it is necessary that the sashes should have a steep slope, in order that the moisture may run down the glass rather than drip on the plants. The frames should not be more than 4½ feet wide. The object of putting up the bed so long before the time of sowing is to allow the litter to settle and fermentation to cease, the stimulus of extra heat not being required.

The soil for the frames should be got ready in the first week of October. It must be light, but it need not be very rich. Leaf-mould is very good, and it may be mixed with a little sand, and put on 6 or 7 inches thick; at all events, it should be filled in to within 5 inches of the sashes. The seeds should be sown in the second week in October. After sowing, the sashes should be kept on till the seeds begin to germinate, when air ought to be freely given, and the sashes drawn quite off in favourable weather during the day. If the plants get frozen, the frames must be kept close till the plants are thawed. If a sash be lifted up when the plants beneath it are stiff with frost, they are almost sure to damp off; therefore great care must be taken in giving air at such times. The external air should not be admitted in large quantity when it is much warmer than the soil in the frame, or the moisture of the warmer air will be condensed, and the plants will be liable to damp off in consequence.

Very little watering will be required. When the plants are up, and as soon as they can be handled, they should be thinned by removing the weakest seedlings, so that those left may be about 1½ inch apart. The aim should be to keep the plants merely growing till the days begin to lengthen; therefore, during December, if occasional sunshine should throw heat into the frame, the stimulus must not be taken advantage of. On the contrary, additional air should be given, so that the sun-heat may escape, rather than accumulate to stimulate the plants.

In January, if the weather be favourable, a more active growth should be encouraged; but it is still desirable that it should be steady. If the plants are backward in growth, the directions for giving abundance of air may be somewhat modified, and less air may be given in January, and till near

Fig. 107.—Cabbage Lettuce—Tom Thumb.

the time of planting out, when the plants should again be freely exposed in all moderate weather. In January the weather is sometimes unusually mild, with a south-west wind, but wet and sunless. There is then danger of the plants drawing up tall and weak before they can be planted out. In this case, whilst the sashes must necessarily be employed as protection from wet, yet they should be removed so as to allow a free circulation of air whenever it can be done with safety.

Planting out is done near London in January, but the preferable time is February. The object is to get the plants well rooted before the dry March winds set in. The ground should accordingly be prepared before that time. It should be light and well manured, not at top, but below the plants. The best kind of manure is fresh littery stable-dung, moistened with the manure-drainings from the stables. The dung should be spread equally over the surface about 2 inches thick. The ground should then be lined off for 2-feet trenches; the first trench being taken out one spade

deep, the dung on the second space of 2 feet should then be turned into the bottom, and covered with 6 inches or so of soil from the second trench ; and so on, till the whole piece of ground be worked over. They are usually planted out at 1 foot apart each way. After planting, although there may be no weeds, yet the ground should be frequently hoed, or its surface otherwise stirred and kept loose. This greatly encourages the growth of the plants. Of course the ground should not be worked or trodden upon when it is in too moist a condition.

The Paris White Cos does not require tying up ; nevertheless, like all other sorts, it is tied before being sent to the market, where, untied, Cos Lettuces would not sell so readily. The plants should be tied up when they are perfectly dry ; strips of matting are used for the purpose, and in applying it the leaves should be first gathered regularly together, but not tightly, and the matting then put round a little above the thickest part of the head.

A succession should be sown in frames in the same manner as already described, but at an interval of not less than three weeks after the first sowing, that is, not before the 1st of November. If there are not at least three weeks between the first and second sowings no succession will be ensured ; for if the second should start more favourably than the first, the crop from both will become fit for use at nearly the same time. About the 5th of November will be a good time for the second sowing. The plants should be managed as directed for the previous sowing.

For a third succession sow again in frames about the end of January, or first or second week in February ; and a small sowing should be made at the end of that month in light rich soil in a frame placed on the ground, or the plants may be sheltered with hand-glasses at night, and also during the day, but with plenty of air.

As soon in March as the ground is in good condition and the weather favourable, sow in some warm situation some of the best Cos and Cabbage varieties. In April the different varieties of summer Lettuces should be sown on a border in front of a west-aspect wall, or between early-dug Celery trenches, more being transplanted to the same site, no other position better favouring the growth of extra-fine Lettuces. During hot dry weather, Lettuces transplant badly, and the late spring and summer sowings ought therefore to be made as much as possible where the plants are to remain. Sow Cos varieties in shallow drills drawn 1 foot apart and previously moistened, thinning to about 10 inches apart, while the Cabbage varieties may be sown in drills 12 inches apart, and left from 10 to 12 inches apart in the rows—rather less space being given the smallest forms. In May and June successional sowings may be made in any open situation, as at this hot period of the season coolness is desirable for this crop. Sowings of Paris Green Cos, Brown Cos, and All-the-year-round should be made in late June and mid-July, for use in autumn and early winter.

Between the 15th and 20th of August sow seeds of the Paris Green Cos, Brown Cos, Brown Dutch, All-the-year-round, and more especially the Hardy Hammersmith, as it is most to be depended on in case of a severe

Fig. 108.—Cabbage Lettuce—Little Gem.

winter. They may be planted on the sides of ridges, which may be formed obliquely across a sheltered border in front of a wall, hedge, or boarded paling, facing the south. If the ridges are made from south-east to north-west, and planted with Lettuces on both sides, those on the north-east will have some portion of the sun's rays to dry the foliage in the morning, and those on the other side, facing the south-west, will receive nearly direct the sun's rays at the hottest time of the day. The Hardy Hammersmith may be planted on these ridges at 6 or 8 inches apart. In planting at the bottom of walls, care should be taken to avoid the drips from the coping.

Another sowing should be made towards the middle of September, for use in spring.

Lettuces are sometimes required for cutting young, or when about 2 inches high. The small early sorts, such as the Hardy Hammersmith, are preferred for this purpose; but any green-leaved sort will do. The seeds should be sown in the open air once a week, or every ten days, from April throughout the season. In winter they are best raised in heat. They should be sown rather thickly, in drills 6 inches apart.

Lettuces raised on an open border, as well as those raised in frames, should be thinned before the plants are drawn up weak and slender, as they never make such full succulent heads as those that by proper thinning have a shorter, thicker stem. Transplanting should take place as soon as possible after the plants have made two or three leaves. Advantage should be taken of cloudy weather for the operation. The ground should be made fine, and for the summer crops it cannot be too rich; in winter the plants will stand better in soil that is rather poor; but when vegetation commences to be active in spring, manure-water will greatly promote their growth.

Forcing Lettuces.—The sorts which may be forced to afford a winter supply are—*Cabbage*: Hardy Hammersmith, White Dutch, Golden Queen, and Early Paris Market;—*Cos*: Brown, Paris Green, and Paris White. Seeds of these should be sown about the middle of August, and in the beginning and middle of September. These sowings ought to furnish plants for a supply throughout the winter and spring.

The seeds should be sown in rich light soil, or in a compost of well-decomposed dung, leaf-mould, and the soil from an old Cucumber bed. As soon as the seedlings are large enough to handle they should be pricked out in a bed prepared as follows:—

About the middle of October make a slight hot-bed, about 18 inches thick, with well-prepared dung. Cover this about 1 foot deep with a compost of sandy peat, leaf-mould, and a little well-decomposed manure. The bottom-heat should be about 55°. When the soil is put in the frame it ought to be thoroughly watered, and then

Fig. 109.—Cos Lettuce—Carter's Jumbo.

allowed to get nearly dry. As soon as this is the case, take up the plants and plant them about 6 inches apart in the frames. Water slightly after planting, and then cover the whole surface of the bed with clean dry sand or dry peat. Some recommend charcoal, but it is apt to soil the foliage; peat-charcoal may, however, be employed with advantage. Shade from sun, and keep the lights close for a few days, till the plants have taken fresh root. Afterwards, give plenty of air when the weather permits. Care should be taken to prevent frost from reaching the plants. In case of severe weather the frame must be backed with litter, and instead of Russia mats, good straw-mats should be used for covering the sashes. In cutting the plants for use, every alternate one should be taken so as to allow those left to develop. Quick-hearting Lettuces may be forced successfully in pots placed near the glass in a house or frame with a temperature ranging from 55° to 65°.

Lettuces are liable to be spoilt by frosts in the autumn. To save them they ought to be lifted and replanted in frames and pits, or in a border where they can be covered with benders and mats as often as need be.

To save Seeds.—The finest specimens

should be selected, those that heart readily, and are slow to run up, being preferred. In order that the sorts may be kept true, care should be taken that different varieties are not grown for seed near each other. The seeds which ripen first on the plant are the best. The branchlets which first ripen their seeds should be cut off, and laid on a cloth in the sun. Or when the forward portion of the seeds is as near maturity as it will safely bear without shaking off, the plants should be carefully pulled up, and placed upright against a south wall, with a cloth under them, to perfect their ripening. The seeds retain their vitality three or four years, although none should be depended on without trial. Plants from seeds two years old heart more readily than those from one-year-old seeds.

Insect Enemies.—Cabbage Moth, Daddy Long-legs, Dart Moth, Ghost Swift Moth, Lettuce Root Aphis, Pot Herb Moth, Wireworm, Yellow Underwing Moth. See chapter on this subject.

The varieties of Lettuce are divided into two classes: CABBAGE, with round depressed or spreading heads; and Cos, with erect conical heads.

Cabbage Lettuces.

ALL-THE-YEAR-ROUND.—Hardy, compact, solid, and crisp-hearted. One of the oldest and most popular.

HARBINGER FORCING.—Valuable on account of its extreme earliness and excellent quality.

COMMODORE NUTT.—An excellent early sort, and one of the best for general use. It is compact, hearts well, is crisp, and exceptionally good in flavour. Colour dark-green.

GOLDEN QUEEN.—A small early variety of a pleasing yellowish hue. It forms solid hearts, and does not soon run to seed. It is one of the quickest to mature.

HAMMERSMITH HARDY GREEN.—Leaves of thick substance, dark-green, wrinkled, and concave. An excellent winter Lettuce, but soon runs to seed in summer.

CARTER'S ROUND LEAVED.—Compact and firm, solid and white; does not run quickly to seed. A very good summer variety.

IDEAL.—A valuable Cabbage Lettuce; hearts solid, of good size, and excellent in quality; leaves slightly tinged with red.

LITTLE GEM.—Dwarf and compact in growth and a beautiful colour (fig. 108).

MALTA.—Leaves pale-green, smooth and soft, dentate, not curled on the margins. Hearts flat, compact, blanches white and tender, less crisp than the Neapolitan, to which, however, on account of its peculiarly soft texture, it is by some preferred, especially for stewing.

NEAPOLITAN.—Leaves much curled on the edges. Hearts large, firm, white, crisp, and of excellent quality. The best of the summer Lettuces. Does not run to seed until late.

TENNIS BALL.—Leaves dark-green, slightly curled; forming a small compact heart, blanching white and crisp. If sown in August it will come in after Hammersmith Hardy Green.

TOM THUMB (fig. 107).—An old favourite, hearts well, is very hardy, stands drought, and is as good in appearance as in flavour. May be had almost all the year round.

Cos Lettuces.

BROWN COS (Bath Cos).—A hardy sort, the best for standing the winter. It grows to a large size, hearts well with a little tying up, and is crisp and excellent. The leaves are brown, but the heart, with tying, can be rendered white. The black-seeded variety is generally preferred. This is also good as a summer Lettuce.

CARTER'S JUMBO (fig. 109).—Foliage deep green; heart immense, solid, up to 6 lbs. each. Flavour excellent. Stands drought well. A champion sort.

DWARF PERFECTION.—An admirable variety for an early crop. If sown in heat in January and planted out when weather permits, it forms a crisp, solid heart before the autumn-sown Bath Cos is ready. It does not readily run to seed.

Fig. 110.—Cos Lettuce—Paris White.

HICKS' HARDY WHITE.—Very hardy, large, and crisp. Stands a long time, and is well adapted for either spring or autumn sowing. It hearts well, and blanches perfectly.

IVERY'S NONESUCH.—Very large; leaves broad and thick, a little tinged with brown; require to be tied for blanching. Has the merit of remaining long without running to seed.

MAMMOTH WHITE (Balloon).—A summer variety which stands drought exceptionally well, and grows to an enormous size. First-rate for exhibition.

PARIS GREEN.—Resembles White Paris, except that it is hardier, and its leaves, till blanched, are dark-green. The heart becomes white, crisp, and excellent. It will stand through ordinary winters, with little protection, in a sheltered

situation. Both White and Green Paris Cos are known under a great diversity of names.

PARIS WHITE (fig. 110).—Leaves large, pale-green, concave so that they close over, and a large heart is blanched without tying. White, crisp, and excellent. It continues growing and hearting for nearly a fortnight after other Cos Lettuces sown on the same day commence to run to seed. Is generally esteemed as the best summer Cos Lettuce, and is the sort most extensively cultivated in the neighbourhood of Paris.

WHITE HEART.—A dwarf broad-hearted variety, self-folding, of excellent flavour, and growing to 6 or 8 lbs. in weight.

LIQUORICE (*Glycyrrhiza glabra*) (fig. 111).—A perennial herb, native of South Europe. It has a fleshy root, which runs deep into the ground, and a stem rising from 3 to 5 feet high, clothed with dull-green pinnate leaves. The sweet mucilaginous juice, extracted from the roots by boiling, is much esteemed as an emollient in colds. Large quantities are grown, for the use of druggists, in the vicinity of Mitcham, in Surrey, to which place its cultivation on an extensive scale is almost entirely confined. A few plants are worth a place in herb gardens.

Fig. 111.—Liquorice (*Glycyrrhiza glabra*).

Liquorice succeeds best in a deep, rich, and rather sandy soil, which should be heavily manured the year previous to planting, and trenched 2 feet deep in autumn, laid in ridges, and allowed to remain in that state till spring; or it may be trenched immediately before planting. The former method is the preferable one.

The roots should be planted in February, in rows 3 feet apart, and 18 inches from each other in the row. Every year, in November, when the sap has gone down and the leaves have turned yellow, the old stems should be cut down with a pruning-knife to the level of the ground. At this time also the creeping stems ought to be forked up, and cut off close to the main stems, and preserved in sand or in heaps covered with straw and earth for future plantations. The ground between the rows should be forked occasionally, and kept free of weeds. The roots will be ready for taking up three years after planting. This should be done in winter. A trench about 3 feet deep must then be got out, and a rope being fastened round the top, the roots should be pulled up and stored in sand for use; if there is a large quantity they may be kept in a clamp like Potatoes.

MARIGOLD (*Calendula officinalis*).—A hardy annual, native of South Europe. It is cultivated in the kitchen garden for its flowers, which are put into soups.

It is raised from seeds sown in March or April, in shallow drills 1 foot apart. When the seedlings are 3 inches high they should be thinned out to 1 foot apart. They flower in June, and continue flowering till September. The flowers may be gathered when full-blown, dried in the shade, and stored for winter and spring use.

MARJORAM (*Origanum*).—The aromatic leaves are used both green and dried for seasoning soups and other dishes. The leafy shoots should be cut when coming into flower, and dried in the shade, for winter and spring use.

Three species are cultivated:—

COMMON MARJORAM (*Origanum vulgare*) (fig. 112).—A perennial, native of Britain, growing naturally in thickets. It may be raised from seeds sown in spring, or by parting the roots in spring or autumn. Plant 1 foot apart in any soil that is not very moist.

POT MARJORAM (*Origanum Onites*).—A perennial, native of Europe. It flowers from July to November, but seldom ripens seeds in England. It is propagated by dividing the roots in March or April, or by slips or cuttings taken off in summer and planted in a frame or under a hand-glass. It prefers a light and rather dry soil and a warm situation, and should be planted in rows 1 foot apart.

SWEET OR KNOTTED MARJORAM (*Origanum Majorana*).—A tender biennial, native of Europe. In this country it will not stand the winter in the open ground; it is therefore raised annually from seeds, sown broadcast on a south border in the beginning of April. Or it may be sown in shallow drills 9 inches apart, thinning out

when the plants are about 2 inches high to 6 inches asunder in the rows. Some may also be sown in March, on a slight hot-bed, either to remain for early use, or to be planted out at the above distances.

The flowers appear in June and July, and are

Fig. 112.—Common Marjoram (*Origanum vulgare*).

collected into roundish close heads, resembling knots, from which circumstances it is frequently called knotted Marjoram. The seeds seldom ripen in Britain.

MINT.—Three species of this are cultivated for economic purposes, namely, Spear-mint, Peppermint, and Pennyroyal.

SPEAR-MINT (*Mentha viridis*).—A hardy perennial, native of Europe, including Britain. The tops are used in soups and salads, in sauce for lamb, and boiled with Peas and other vegetables. It prefers a moist soil, but will grow in almost any soil and situation. It is easily propagated by dividing the roots, or by offsets, in spring; also by cuttings about 6 inches long, taken off in summer, planted about 3 inches deep, and watered till they take root. In winter the old stems should be cut down, and the beds cleaned and covered with mould to the depth of 2 inches. In some soils, fresh plantations require to be made every three or four years; in others, only after the lapse of several years. When the plants are coming into flower, a quantity of tops should be cut and dried in the shade, or in a screen before the fire, for use in winter. A supply of green Mint may be had all through the winter by removing some roots to a warm frame, planting them in light soil. They should be exposed to sun and air in mild weather.

PENNYROYAL (*Mentha Pulegium*).—A hardy perennial, a native of Europe, including Britain. It succeeds best in a moist loamy soil, and is easily propagated by offsets, or by dividing the roots in September, March, or April. Plant in rows 1 foot asunder, and 6 inches from plant to plant in the row, and water at planting.

PEPPERMINT (*Mentha piperita*).—A hardy perennial, a native of Europe, including Britain. It is principally cultivated for the distillation of the well-known cordial that bears its name. It requires the same soil and treatment as the preceding species, and is propagated in the same way.

MOREL (*Morchella esculenta*) (fig. 113).—An edible fungus found growing in orchards, woods, and moist pastures. It is said to occur most abundantly in places where wood has been burned, or charcoal made. It grows to about 4 inches in height, and consists of a smooth white cylindrical stem, and a hollow spherical cap adhering to the stem by its base; pale-brown or gray in colour, and marked with deep pits all over its surface. The Morel is used either fresh

Fig. 113.—Morel (*Morchella esculenta*).

or in a dried state, in gravies, stews, &c. It usually makes its appearance in spring or early in summer. It should not be gathered when wet, otherwise it will not keep well. It has not as yet been subjected to cultivation, but it is probable that if Morels commencing to decay, and the soil about them, were collected, and placed under different circumstances of soil, heat, and moisture, the attempt might prove successful, and a proper mode of cultivation be arrived at.

MUSHROOM (*Agaricus campestris*) (fig. 114).—The Common or Field Mushroom grows wild in meadows, pastures, &c., and is most abundant in autumn. It is also largely cultivated, and in some countries Mushroom production has developed into quite an important industry. Like all Fungi it produces spores in abundance, but these in the field Mushroom do not appear to vegetate. It is, however, easily multiplied by means of the mycelium or "spawn." This has the appearance of a white thread-like mould, which retains its vegetative powers for many years, provided it is kept dry; but if placed in a proper medium, and afforded heat and moisture, it ramifies in all directions in suitable soil in the night. The Mushroom is of course exposed to light during the day, and that may be of importance in perfecting the spores; but in other respects light is not essential. The Mushroom makes in the open pasture the bulk of its substance in the night, and even the salmon-coloured tinge of the gills is acquired in the dark.

Mushrooms, like other species of Fungi, abound in nitrogen; this substance must therefore be considered a necessary element of their nutrition, and unless substances rich in nitrogen are supplied, their cultivation cannot be attended with success. Nitrogen is found in considerable quantity in the dung of horses and cows, and accordingly these substances are generally employed in

Fig. 114.—Mushrooms (*Agaricus campestris*).

or other substances favourable to its growth. When the spawn begins to run, as it is termed, it may be propagated to a great extent. The spawn may be safely exposed to a temperature of 80°. Proof of this is afforded by the fact that, if inserted in Melon-beds, it increases or runs in the soil, whilst the Melons are growing in a temperature of 80°; and when the crop of Melons is ripened off, the beds cleared and sufficiently watered, and the temperature lowered, a crop of Mushrooms springs up.

Light is not essential for the growth of Mushrooms, for, although they grow naturally in open pastures, and dislike moist shady situations in which many other species of Fungi abound, yet it will have been observed that in those pastures the development of the Mushroom above-ground occurs chiefly the cultivation of the Mushroom. They are subjected to fermentation, but this evidently must not be carried too far, otherwise the nitrogen would be driven off in the form of ammonia. The substances from which the Mushrooms derive their principal supply of nourishment require to be coated with some earthy material, so as to absorb the ammonia which would be driven off by fermentation; they must also be rendered compact by treading or beating, in order that the fermentation may be rendered slower, and consequently more lasting.

Preparation of the Spawn.—For the artificial production of Mushrooms, good spawn is necessary. Brick spawn (fig. 115), so called from the materials being worked up and cut or moulded like bricks, is made as follows: Fresh horse-droppings, cow-dung,

and a little loam are mixed and beaten up with as much stable-drainings as may be necessary to reduce the whole to the consistence of mortar. It may then be spread on the floor of an open shed, and when somewhat firm it may be cut into cakes of 6 inches square, placed on edge in a dry, airy place, and frequently turned and protected from rain. When half dry, make a hole in each with a dibber, so as to admit of about 1 inch square of good old spawn being inserted so deeply as to be a little below the surface ; close it with some moist composition similar to that of which the bricks were formed. When the bricks are nearly dry make, on a dry bottom, a layer 9 inches thick of horse-dung, prepared as for a hot-bed, and on this pile the bricks rather openly. Cover with litter, so that the steam and heat of the layer of dung may circulate among the bricks. The temperature should not rise above 60°. The spawn will soon begin to run, and when, on breaking a brick, the spawn appears throughout pretty abundantly like a white mould, the process has gone far enough. The bricks should therefore be removed, allowed to dry, and then be kept in a dark dry place.

As there is so much difference of opinion as regards the substances employed in making spawn-bricks, and as different combinations of them are successfully employed, it will be worth while to endeavour to ascertain whether there is not one common principle in all of them, which is more especially essential for the growth of the Mushroom. The quantity of nitrogen which it contains being much greater than in other plants subjected to cultivation, it follows that this element must be abundantly supplied ; and accordingly all the substances usually employed for the spawn to feed upon contain nitrogen in considerable quantity, as in the case of horse, cow, and sheep's dung. Analyses of these are of course subject to variation ; but those made by Boussingault, and other eminent authorities, may be considered a fair estimate of the percentage of nitrogen which the substances in question usually contain, and this is exhibited in the following table :—

	Solid Excrements.		Urine.
	Fresh.	Dry.	
Horse	0.54	2.2	1.55
Cow.....	0.32	2.3	0.44
Sheep	0.72	1.7	1.31

From the above it appears that in the solid excrements of the horse there is rather more than one-half per cent of nitrogen, in that of the cow scarcely one-third per cent, while in that of the sheep there is nearly three-fourths per cent. The amount of nitrogen in dried horse and cow dung is nearly equal, and about one-fourth more than in dried sheep's-dung. The urine of the horse, it will also be seen, yields a large amount of nitrogen.

Although horse-dung contains a greater amount of ammonia, and ferments more readily than cow-dung, yet the heat of the latter continues longer, and on this account a mixture of the two may be employed for the growth of Mushrooms.

Some recommend these substances to be used in a fresh state, others after they have undergone a considerable degree of fermentation. In the latter state, much of their nitrogen must have been driven off in the form of ammonia, so that there is no question as to the superiority of the fresh materials, if the heat generated by such can be controlled ; but this is the difficulty. They can be disposed in thin layers, but then they do not afford such good produce as when in a greater mass. It may here be observed, that firmly beating the materials tends to lessen the fermentation, and by

Fig. 115.—Mushroom Brick Spawn.

boring holes the heat is permitted to escape, but likewise the ammonia, which it would be desirable to retain for the benefit of the crop. Therefore, whilst the fermentation is going on, the beds should be covered with loam, by which much of the ammonia will be absorbed. For the same purpose a little leaf-mould might be spread over the surface of the dung, and then about 2 inches thick of loam, or of a compost of loam and cow-dung which has been frequently turned, and the different substances thoroughly mixed and incorporated.

Ridge Culture.—Mushrooms are largely cultivated by market-gardeners near London. Their mode of procedure is simple. The ridge is formed of dung fresh from the London stables, and prepared by being thrown into long narrow heaps and turned as often as the centre of the heap becomes hot. It is ready for use after about a fortnight of this treatment. The beds are formed on a hard piece of ground, and are 3 feet wide at the base, being brought up to a very narrow ridge at top, to which the sides form a steep slope. The dung is made compact, and covered with mats or long litter to keep out the wet, and bits of spawn are inserted 6 or 8 inches apart when the heat is declining below 80°. The sides are beaten as closely as possible, and the whole is then covered about 2 inches thick with a fine adhesive loam, and beaten with the back of the spade, so that it becomes a compact casing to the bed. Formerly it was the practice to water this surfacing of soil and bring it to the consistency of mortar, but these plastered surfaces invariably shrink and crack, breaking the Mushroom threads wholesale. The heat is regulated more or less by the thicker or thinner covering of mats or litter, and if likely to become too cold, the bed is covered with warm litter. It should not be allowed to cool more than is proper, and then be warmed up by hot dung. Care must be taken to protect the beds from rain, for if they were allowed to get too wet the spawn would not run, and for this purpose long litter, mats, or tarpaulins are usually employed.

Mushrooms can be obtained in abundance for a good part of the year from beds formed out of doors as above described, but the uncertain state of the weather occasions much more labour in regulating the covering than is required in growing them in a house where they are not exposed to extremes of temperature and moisture.

House Culture.—A Mushroom-house may have either a span or a lean-to roof. A width of 10 feet is good, with a path 3 feet wide, a bed 3½ feet wide on each side. If the north wall were built hollow, it would resist sudden changes of external temperature, and the same would be the case with the roof if it were covered with a thick coat of thatch, either straw or heath; but thatch, except in particular situations, is unsightly, besides being dangerous in case of fire; consequently slates will be chiefly employed instead, although in sunny weather they become hot, and transmit much heat to the interior. It will therefore be advisable, in the case of the Mushroom-house, to have a double roof or ceiling, the side filled up with brick shelves, having in front upright ledges 9 inches deep, and 2 feet ought to be allowed from the bottom of one shelf up to that of the one next above it. Moisture is readily diffused through bricks, so that if their outside is moist from vapour in the house, their inner surface in contact with the materials of the bed will not be injuriously dry.

Where brick shelving has been tried the crop of Mushrooms has proved much superior to those on wood; and this being the case, the question is only one of expense as regards the first outlay.

Although for the greater part of the year a well-constructed Mushroom-house will not require fire-heat, yet, in severe winters, it is necessary to have it at command. A little will suffice, especially as the doors

Fig. 116.—Mushroom Cave in Paris.

should be made to shut closely, and the windows ought to be furnished with close-fitting shutters. A small hot-water apparatus, with a flow and return 3-inch pipe, will answer the purpose. The pipes can be laid either in a channel under the footpath, where they can be covered with a grating or wooden trellis; or they may be placed along each side of the path, and saddled with movable evaporating troughs, made either of iron, tinned or galvanized, or of earthenware. If more vapour should at any time be required than will rise from these troughs, some of them may be removed, and the hot-water pipe watered through the rose of a watering-pot. A dense steam can be still more readily produced by means of

an inch pipe fitted into the top of a small boiler, which may be placed in an adjoining shed or other convenient situation.

The material chiefly employed for beds indoors, and in pots or boxes, or on shelves is the droppings of horses fed on corn and hay. They should be collected fresh, and laid in thin layers or small ridges in a dry place. The long litter ought to be shaken out and dispensed with; but a portion of the short litter may be retained, provided it has been well moistened by the urine of the horses. These materials should be frequently turned and maintained in an incipient state of fermentation until the rankness is got rid of. In order that the ammonia may not be lost, the dung may be mixed with a little rather dry friable maiden loam. The manure should be distributed evenly in layers and the beds made firm; they should be about a foot deep at the back and an inch or two less in front.

An experienced grower recommended horse-droppings to be collected and dried a little in an open shed, a stratum of loamy turf 2 or 3 inches deep to be placed in the bottom of the bed, and then three layers of droppings, each layer being rendered as compact as possible. When the mass heats, holes are bored 9 inches apart and as deep as the loam, and when the heat declines to 80° the holes are partly filled up with loam and horse-droppings mixed; a piece of spawn about the size of a hen's egg being inserted in each, they are then filled up level with the surface. If the beds are to be of considerable thickness, say 1 foot or more, then it is well to mix the materials with loam in order to prevent the fermentation becoming too violent; but when they are chiefly composed of droppings they must be made thinner, in which case they will not continue so long in bearing.

The spawn should be in lumps 2 inches square; these are placed 6 or 8 inches apart a little below the surface when the heat is 75°, or on the decline from 80°, a temperature which the materials ought never to exceed. In this and all other instances, trial sticks or plunging thermometers ought to be used. On the least signs of vapour being unduly confined, holes should be opened to let this out, otherwise injurious overheating will result. Pointed iron rods are sometimes needed for boring holes through the centre of ridge-shaped beds. When it is seen there is no likelihood of overheating taking place, soil over at once, the surface of the bed to be covered thinly with loam, and in a week or ten days this covering should be made up to 2 inches thick. When put on it ought to be as warm as the materials of the beds. The whole is then covered with hay or litter.

The temperature of the house should be kept at between 60° and 65° till the Mushrooms appear; afterwards it may be from 50° to 55°. When in bearing, the productiveness of the beds is sometimes injuriously affected by excess of water. When moisture is needed it is best to well moisten the covering of hay and litter, but not the beds themselves. The water used for this purpose must be of the temperature of 80°.

Always twist off the Mushrooms, and when possible remove the solid mass of roots at the base, filling up the holes thus caused with fresh loam. When cutting is resorted to, the old stumps decay rapidly, and quickly cause masses of mould or fungus to appear, which in their turn destroy all the Mushrooms, large and small, they come into contact with.

MUSTARD (*Sinapis alba*).—A hardy annual, a native of Europe, including Britain, where it is found in fields and waste places. The white Mustard is only used, generally along with Cress, as a salad, for which purpose it is cut while in the seed-leaf stage.

It is raised from seeds, which may be sown every week or ten days throughout the year, either in the open ground or in heat, according to the season. The sowings in the open ground may be commenced about the middle of March, and given up about the middle of October. The ground where it is to be sown should be light, rich, and raked very fine; for the early and late sowings a warm spot should be selected; for those made in the heat of summer, a shady situation must be chosen; at other times any open compartment with good soil will do. It should be sown thickly, in shallow drills 6 inches apart, and only slightly covered with earth, after which the surface should be pressed smooth with the back of the spade, so that there may be no roughness to interfere with the cutting. With the exception of watering the seed-bed and the young plants in dry weather, no further culture is necessary. In gathering, the plants are cut over by the ground; if allowed to remain they will put forth leaves a second time, but those first produced are greatly to be preferred.

Forcing.—The seeds of Rape are largely substituted for those of Mustard. The seeds to be forced ought to be sown very

thickly in shallow boxes or square pans, on the surface of quite fresh, previously moistened soil, pressing it into the surface rather than covering with fine soil. Place in any structure where a temperature of from 55° to 70° is maintained, or on an old hot-bed. Cover with either brown paper or mats, and do not withdraw these till the stems are an inch in length, afterwards gradually exposing to the light. In this manner only is it possible to have the long well-blanched stems, such as market-growers know are needed, and which private gardeners too often fail to produce. On no account use stale soil, or that which has been previously used for a similar purpose, as this is almost certain to end in feeble growth and wholesale damping. On a large scale, the seeds may be sown on good fine soil, rotten tan or leaf soil, in any place where the necessary amount of heat, light, and moisture is at command.

To keep the seedlings free from grit, which is not easily washed off when preparing them for the table, it is a good plan to spread a piece of thin canvas over the soil and sow the seeds *on* the canvas, which is easily kept moist, and on which the seeds germinate readily, their roots easily gaining access to the soil and developing long stems which may be cut off close to the canvas, and be so clean as not to require washing.

NASTURTIUM, or INDIAN CRESS (*Tropæolum majus*).—A native of Peru, where it is a perennial, but it is treated as an annual here. The leaves, young shoots, and flowers are frequently eaten in salads. The flowers are used as a garnish. The young flower-buds, leaves, and fruits, gathered when green, are pickled in vinegar, and employed instead of capers, which they somewhat resemble in flavour, and to which many persons consider them preferable.

Fig. 117.—Tuberous Nasturtium (*Tropæolum tuberosum*).

The plants succeed best in a light rich soil, with a warm aspect. They are raised from seeds sown in March or April, 4 inches apart, in drills 1 inch deep. They may be staked like climbing Peas.

The tuberous Nasturtium (*T. tuberosum*) (fig. 117) is a South American climbing or trailing perennial, with fleshy Potato-like tubers coloured bright orange mottled with red. When boiled they have an agreeable flavour, but they require to be carefully cooked to be palatable. In South America, where these tubers are a well-known and favourite dish, they are boiled and afterwards frozen before being eaten. They have been tried in Covent Garden Market, but they have never found much favour.

NEW ZEALAND SPINACH (*Tetragonia expansa*) (fig. 118).—A hardy annual

Fig. 118.—New Zealand Spinach (*Tetragonia expansa*).

from New Zealand, whence it was introduced in 1772 by Sir Joseph Banks. Though inferior to Spinach it forms a good substitute for that vegetable, especially in the hot dry months of summer, when the common Spinach runs so quickly to seed, that even with frequent sowings it is sometimes impossible to gather a good dish. On the other hand, the New Zealand Spinach, under the same circumstances, always produces, when properly cultivated, an abundance of succulent leaves.

It is raised from seeds, which should be steeped for twenty-four hours before sowing. It should be sown in March on a gentle hot-bed, placing the seeds 3 or 4 inches apart. When the seedlings have grown to the length of 2 or 3 inches, they may be lifted, and planted singly in small pots, which should be placed under a frame till the middle or end of May, when the young plants may be planted out. This should be done in a light rich soil, with a southern aspect. The distance between the plants in the row may be 3 feet, and between the rows 4 feet. If planted on a border sloping towards the south, the plants should not be less than 18 inches from the path, as they

will incline to grow most in that direction. Water should be given at planting, and afterwards all the care they will require is confined to watering frequently in dry weather. In gathering, the young tops and leaves only should be taken; abundance of fresh ones are produced throughout the summer and autumn. Seeds may be saved by placing a plant or two in poor soil, in lime rubbish, or by training them against a wall. In warm seasons, however, it ripens its seeds in the open ground.

ONION (*Allium Cepa*).—A hardy biennial, a native of Central or Western Asia. The Jews had a city called Onion, built by Onias (B.C. 173), near the Gulf of Suez, which existed for 243 years, and it is not improbable that this vegetable, long used among the Egyptians and Jews, may have obtained in comparatively ancient times the name which, with little variation, in this and other European countries, it still retains.

The uses of the Onion are universally known, and few plants have such a wide range of cultivation; for it is grown from the tropics to the coldest verge of the temperate zone. The leaves and roots are of an annual nature, inasmuch as they die in the course of a single summer after perfecting a bulb; the latter, however, is biennial, and after a temporary rest it has the power of emitting new roots, pushing fresh leaves, and sending up a flower-stalk. In some cases it also forms offset bulbs.

Soil.—Onions succeed best in an open situation in rich loam, but they can be grown in almost any kind of soil, providing it has been well cultivated. The ground should be trenched to a depth of 2½ feet, breaking up the bottom, and leaving the surface in a rough state to be weathered. It should afterwards be well forked over to ensure a good tilth, as on this depends so much the success or failure of the crop. Light soils should be made moderately firm. Onions will ripen better in dry light soil in a cold wet season than in soil of a contrary description. If circumstances will permit, it is advisable to grow a portion of the crop on warm and rather dry soil, calculated to yield comparatively sounder produce than can be obtained from ground that is cold and wet. The soil should be well drained. If the subsoil is too retentive, the ground should be sub-trenched. When this is done there will be a free passage for air and moisture throughout the soil.

Manures.—In the preparation of the ground manure is important, farmyard manure being best, especially where the cattle have been well fed. Cow manure is most suitable for light soils and horse manure for heavy soils. These may be supplemented by others, such as poultry and

Fig. 119.—Onion—Sutton's A1.

sheep droppings. The whole should be well incorporated, using the longest in the bottom to act as drainage.

After the ground has been trenched and manured a dressing of soot and bone-meal should be applied. If the soil has been heavily manured for many previous years a dressing of lime is helpful. Wood-ashes and charred rubbish are good along with other manures. The market-gardeners near London sow salt and soot along with the crop, and their crops of Onions are generally very fine.

Spring-sown Onions.—The precise time of sowing the main crop cannot be stated, for it greatly depends on the state of the weather and the nature of the soil. From the middle of February to the middle of March is the usual period; but should the ground be either frozen or covered with snow, or saturated with rain, then the first opportunity should be seized. In bad springs or in very cold situations the beginning of April would not be too late.

The ground having been rendered friable, it should be dug over in the end of February or early in March, in small spits the full depth of the spade but narrow, each spit to be thoroughly broken before another is turned over. The ground should not be made fine merely on the top, leaving the rest of the spit in coarse lumps, but the whole must be thoroughly broken.

If the soil is light it should be trodden or rolled ; and heavy soil should also be lightly rolled, if rather dry at the time, but not otherwise. In cold low-lying positions the ground may be marked off in 4-feet beds, with 1-foot paths between. The drills should then be drawn 9 inches apart, or 12 inches for the large sorts. As a rule the plan of sowing quite on the level and in drills 12 inches apart answers well, and is much the simplest. In order to have well-formed, sound, keeping Onions, the seeds cannot be too near the surface, so long as they are just covered. The seeds, if good—and this ought to be previously ascertained—should be sown thinly along the drills, then covered with a little finely-broken soil, and trodden, smoothed with the rake, or rolled with a roller of greater or less weight, according to the nature of the soil, for the lighter it is the more it should be pressed. In many cases a roller may not be at command ; if so, the surface of the bed should be beaten with the back of the spade.

Instead of drawing drills, the line may be stretched, and a round straight rod, about ¾ inch in diameter, laid alongside of it, then by treading or otherwise pressing down the rod, a groove of uniform depth, smooth and firm at bottom, will be formed. In this the seeds can be regularly sown, and covered with a little mould. The advantage of this system is that all the seeds will be near the surface, whereas when drills are drawn in the ordinary way, some seeds drop into holes, and from being too deeply buried are apt to produce thick necks.

After sowing, weeding, thinning, and watering are all that are necessary till the crop is mature or nearly so. It will be observed that the plant does not come up with an erect point, but is doubled like a whip, and as it advances in growth the point gets clear of the soil. Very soon after this takes place the surface of the ground should be hoed in order to cut up all seedling weeds, and at the same time the Onions should be thinned with a small 2-inch-broad hoe. The first thinning ought to be partial in case of failure. Hoeing and weeding should be repeated as often as may be necessary. Although the surface of the soil should be hoed in order to destroy weeds, and although the growth of the young plants may be promoted by the shallow stirring requisite for that purpose, yet the deep loosening of the soil, so beneficial for many crops, is not so for Onions. The best-formed and soundest bulbs are grown where the surface is rather firm than loose. It has frequently been observed that where the soil of the beds has been loose, the best Onions were those which sprung from seeds accidentally dropped on the paths.

The final thinning should be to the distance of from 4 to 6 inches in the row, according to the richness of the soil and the size which the variety attains. If very large Onions are required, the drills may be 15 inches asunder, and the plants thinned to 9 inches in the row ; and if the seeds are sown broadcast, each plant should be allowed from 5 to 8 inches square. When the weather is dry, watering in some cases is beneficial till the tops acquire a good size ; but when there appears a disposition to form thick necks, a slight check from drought will assist in the formation of bulb, as also will twisting the necks so as to cause the tops to fall over.

When the foliage begins to flag and the stems to bend, it is a sign that they have performed their part as regards the growth of the plant, and the first spell of dry weather should be seized to pull up the bulbs ; after heavy rain it would not be desirable to do so till several dry days have elapsed. But whatever may be the state of the weather, care should be taken to pull up the Onions before a second growth commences. Some idea of how Onions should be treated will be obtained from fig. 120, reproduced from a photograph. If wet weather should prevail, the best plan is to take the crop up, and lay it on a dry surface, sheltered from rain, but exposed to air and to whatever sunshine there may be. Onions when pulled are usually laid on the ground with their roots towards the south, in order that the sun's rays may assist in ripening them. They should be turned over on a dry day, and when the surface of the ground is dry. In private gardens it is sometimes possible

Fig. 120.—Roped Onions.

Fig. 121.—War-Time Onions in the Flower Garden at Kew.

to lay the Onions on a dry gravel walk, or some other hard surface, and this is preferable to the cultivated ground. Anyway, they must be thoroughly harvested, if necessary, in a dry heat or the floor of a vinery cleared of fruit. When the roots and tops are completely withered the greater portion of the latter should be taken off, and the bulbs may then be stored in a dry cool place. They keep very well in a loft above an open shed, secured, however, from frost by a covering of straw, and a lining of the same material round the walls. They also keep well strung together by their necks on a straw rope, and suspended so as not to touch the walls of the place in which they are stored. Onions have been known to keep well till late in the spring by storing them several feet thick in a cool loft, without disturbing them till finally removed for use.

Onions for Pickling.—White Spanish or Reading, Silver-skinned, Early Silver-skinned, and Queen, are sorts specially recommended for this purpose; but the Silver-skinned varieties are preferred for their finer appearance in pickle-jars and at table. As security against failure some of each of these may be sown in March. The ground should be rather poor than rich, and not manured. The seeds should be sown thickly, covered very slightly, and well rolled. Thinning is not required except where the plants have come up too close together.

If seeds of Onions are sown in spring, the plants cultivated so as to attain a fair size, and taken up when mature and replanted in the following spring, they push fresh roots, flower, seed, and then die; but if sown in autumn, they will survive ordinary winters, and develop into large bulbs in the course of the following spring and summer. If an early sort be sown thickly in not very rich soil in the beginning of May, small bulbs will be matured sufficiently well to keep through the winter; and in consequence of having been sown late, and from being of small size, they will not be disposed to run to seed when replanted in spring, and their vegetation not taking that direction, the small bulbs become very large. It thus appears that very large Onions result from two seasons' growth, as is the case when the small bulbs of one year's growth are planted in the spring of the next, or when a growth made in autumn is continued in the following spring and summer. In Portugal, Onions do not require to be sown so early in the autumn as in Britain; but they are forwarded in a little heat in November and December, and thus make a considerable growth before the spring-sown Onions are above-ground. From having this advantage, they swell to a much larger size than those sown in March, which have consequently a much shorter period of growth; for, whether sown in autumn, or early or late in spring, the Onion has a disposition to rest after the summer is over.

In order to have extra fine Onions to come under the designation "spring-sown," exhibitors sow seeds of the large varieties of the White Spanish type in pans of good soil, and place them in a moderate heat early in February. Not being raised thickly no thinning or pricking out is needed, but the plants are kept growing sturdily near the glass in gentle heat till large enough to plant out, when they are hardened off and a favourable time selected for dibbling them out on extra-well-prepared ground where they are to grow. This plan has been adopted on a large scale in America, as it is found to be the surest method of securing an even crop of extra-fine, perfectly-matured bulbs.

Autumn Sowing.—If the plants are not to be transplanted in spring, seeds of the White Spanish, or of the Silver-skinned, should be sown about the 17th of August.

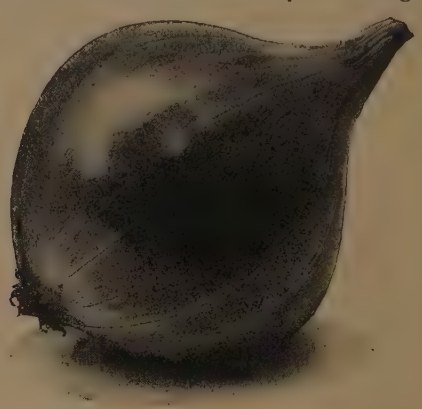

Fig. 122.—Onion—Perfection.

The seeds require to be covered to a greater depth than those sown in spring, otherwise they are liable to be thrown out of the ground by frost; on this account, in sandy soils an inch deep will not be too much. The plants should be thinned as necessary.

If intended for transplanting in spring the White Spanish or Reading and Tripolis should be sown early in September, and transplanted in spring into ground prepared as for the spring-sown crops. The plants should be carefully removed from the seed-

bed, in order that their roots may be preserved as entire as possible. The ground having been prepared, let a line be stretched, and the surface made smooth and close by beating with the spade, lightly if the ground is rather moist and strong, more heavily if light and sandy. Next cut by the line a small trench, and if some good compost can be spread in the bottom so much the better. Then, with the plant in one hand, place the roots so that the fibres only shall be under the surface. The fibres should then be spread out and covered with soil by hand. When the row is planted, and the soil levelled, the latter should be made even, and rendered moderately compact with the back of the spade. If Onions for drawing young are likely to be in demand, the plants may be put at half the distance in the rows at which the crop is to remain, and every other one taken out for early use.

Planting Small Bulbs of the Preceding Year's Growth.—These are obtained by sowing seeds of White Spanish or Reading, about the 10th of May, in dry, rather poor soil, in the manner directed for sowing pickling Onions. If the weather be dry, give a good watering immediately after sowing, but no more. Let the bulbs be taken up when ripe, and when perfectly dry they may be kept in paper bags, in a cool place, till the beginning of February, when, if the weather permit, they should be planted in rich soil, 4 inches apart in rows 12 inches asunder; or 6 or 8 inches apart in rows 1 foot from each other, if very large bulbs are desired. The bulbs should be taken between the finger and thumb, and pressed a little way into the ground. If there should be any small Onions they may be planted in the same way.

Offset Onions.—By sowing thickly in April, and allowing the plants to remain without thinning, bulbs of small size will be produced. Those of the size of Walnuts, or still larger, should be planted in January or February, pressing the bulb into the ground so as scarcely to cover it. When the stem begins to shoot up to flower it should be broken off, and in consequence of the check to the growth in this direction young bulbs, known as "scallions," form round or out of the old ones. Onions 2 or 3 inches in circumference, and fit for the kitchen, may thus be obtained at a time when spring-sown Onions are not larger than quills, and Onions thus thrown into clusters will be full grown and fit to take up by the end of June. They do not keep; but this, we may add, is of no great consequence, as their principal use is to afford a supply between the new and old crops.

Potato Onion.—This is generally planted as early in the spring as the weather will permit, but it may be planted in December, especially if the bulbs then begin to push. The ground should be deep, rich, and well

Fig. 123.—Potato Onions.

prepared; the bulbs should be planted almost on the surface, and in rows 15 inches apart, and about 10 inches from each other in the row. In Devonshire, where this Onion is much cultivated, the rule is to plant on the shortest day, and to take up the crop on the longest. They are planted in rows 12 inches apart, and at 6 inches from

Fig. 124.—Egyptian Onions.

each other in the rows. The winters in Devonshire are mild, but in parts of the country where this is not the case, early spring planting is to be preferred.

Egyptian Onion.—This may be propagated from the bulbs formed in the ground; also from the small bulbs formed in the head. The former are planted 1 foot apart each way, in shallow drills, about the same time as the main crop of Onions is sown in spring, and the others about the beginning of April, 6 inches apart, in rows 12 inches asunder. Stems that bear heavily require to be supported. When mature, the head-bulbs should be gathered, dried, and kept in a cool dry place.

Fig. 125.—Onions grown for Seed.

The attempt is made to grow Onions in almost every cottage-garden. We may therefore give one of the modes of cultivation by which difficulties in the way of raising good crops on indifferent or even poor soils have been overcome, and from which some useful hints may be obtained. The following method, of which the peculiar advantage is, that good Onions may be obtained by it on a very moderate soil without the abundant supply of manure which broadcast sowing requires, was recommended by Mr. James:—

The seeds are sown on a slight hot-bed in the second week in March; the plants, when up, are exposed to the air whenever the weather permits, and in the last week in April they are planted out in the following manner: Deep drills are made on a piece of well-dug ground, 15 inches asunder, and the drills are filled with a good compost of equal parts of sandy loam and rotten dung; the plants being drawn carefully from the beds, are placed in these drills at 12 inches distance from each other, their fibres only being covered with the mould, and the entire bulb kept above-ground. When planted, they receive a gentle watering, which is continued daily, unless rain falls, till the roots have got hold of the compost. They are afterwards hoed when necessary, and occasionally watered, till they are fit to take up. By sowing Onion-seed on a good south border in the second week in September, the plants, if of a hardy variety, will stand the winter, and they may be treated in the spring as above described, with the same success as if they had been raised on a hot-bed.

Forcing.—When young Onions are required in winter for salads, the seeds may be sown thickly in pans or boxes of light rich soil, placed near the glass in a vinery or

other structure where a temperature of from 55° to 65° is maintained. The Onions are drawn for use in a very young state, and a sowing may be made every fortnight if a constant succession is required.

To save Seeds.—For this purpose select some of the largest and best-formed Onions when the crop is taken up. Plant them either in November or February, in warm soil, and in a situation well exposed to the sun, but sheltered from wind. In planting, drills should be formed 3 or 4 inches deep, according to the size of the bulbs. These should be planted in perfectly straight rows, 18 inches apart and 12 inches asunder in the row. Instead of drills, the bulbs may be planted in holes made with a trowel. The flower-stems require support as they advance in height. Stakes should therefore be driven in, and tarred cords stretched horizontally on each side of the row of stems. In August or September, when the seeds are ripe, the stalks should be cut over by the ground and laid on a cloth in the open air for a few days to dry; but during this process the seeds ought not to be exposed to rain. The seeds keep good for two years, seldom longer.

Enemies.—Brassy Onion Fly, Millipedes, Onion Fly, Wireworms. See chapter on this subject.

There are many varieties, all more or less subject to variation, so that if shades of difference were taken into account, names would be uselessly multiplied. It is necessary, however, to distinguish the sorts that are early or late, large or small, mild or strong, and such as keep only a short time or till late in spring. The principal of these are :—

Ailsa Craig.—This remarkable Onion holds the record for weight both as single bulbs and in groups of one dozen or more, namely, 3 lbs. 7½ ozs. for a single specimen, and 37½ lbs. for one dozen roots. It is of more value for exhibition than for use.

Bedfordshire Champion.—One of the best and most popular of the large globe Onions. In shape it resembles James's Keeping, but is paler in colour and milder in flavour. One of the most reliable, and a good keeper.

Blood-red.—Middle-sized or rather large, flattish; skin dull-red, the layer next below it glossy and very dark-red; flesh very firm and solid, white; the internal layers palest at the base, and, except at the top, only coloured on their outsides; each layer is paler than the one which surrounds it till the centre is reached, which is white. Strong in flavour, and a late keeper.

Brown Globe.—Medium-sized, globular or obovate with a high rounded crown; skin reddish-brown; flesh pale throughout, or sometimes in rather darker-skinned forms having a slight shade of red as an outside coating to the various layers. An excellent and much-esteemed keeping variety. *Magnum Bonum* is a fine form of this.

Brown Spanish.—Medium-sized, flattened or oblate, regular and even in form, with a small neck, of free growth, very hardy, and ripening early; skin dark reddish-brown; flesh firm and solid, tinged with red. A good keeper of excellent quality. *Strasburg* and *Deptford* are forms of it.

Egyptian (fig. 124).—When the flower-stalks of this Onion are allowed to run up, they become viviparous, small bulbs about the size of marbles being formed at the top instead of flowers. A few offset bulbs are also formed under-ground, and by these, but chiefly by the little bulbs on the stem, the variety is propagated. The stem-bulbs are excellent when pickled.

Improved Reading.—A maincrop Onion of excellent shape and mild flavour. An exceptionally good keeper, remaining sound after other varieties have decayed.

James's Keeping.—Large, pear-shaped; skin

Fig. 126.—Onions—Sutton's Queen.

brown; veins purplish-red; flavour strong. Much esteemed for its long and sound keeping qualities.

Lisbon.—Large, globular, the neck rather thick; skin smooth, thin, clear and white. A late but hardy sort; if sown in August it affords a good supply of young Onions for spring salads; or if transplanted from the autumn-sown beds in April, large bulbs will be formed towards the end of summer.

Carter's Record.—One of the largest globe-shaped Onions in cultivation, excellent for autumn or spring sowing.

Perfection (fig. 122).—An ovate solid Onion which attains a very large size, and is suitable either for spring or autumn sowing, but the finest results are obtained from the latter. Skin yellow, flavour excellent, keeps well.

Potato (fig. 123).—This forms a number of bulbs on the parent root beneath the surface of

the ground, and by means of these it is propagated, and in this way an abundant supply may be ensured, even in seasons when the sorts usually raised from seeds either wholly or partially fail. Or, if other kinds do not keep well, as is frequently the case, the Potato Onion will afford a supply before the others are fit. The bulbs are of average size, somewhat irregular, with a loose reddish-brown skin; flesh tolerably firm and solid, and of fair quality. It is very prolific.

Queen (fig. 126).—Forms bulbs as quickly as a Radish, is a two- or three-leaved form of Silver-skinned, with small round white bulbs, and is probably the same as Nocera, as introduced many years ago. Sutton's Queen is a superior and fixed strain of it.

Rousham Park Hero.—A large handsome variety of the Spanish type. A favourite for exhibition.

Silver-skinned (White Egyptian, Early Hard Dutch).—Bulb roundish-oblate; skin thin, white and shining; the layer beneath of a beautiful clear white, striped with fine green lines; flesh pure white, firm, and solid. Much esteemed and cultivated for its mild quality, and for pickling.

Sutton's A1 (fig. 119).—Midway between Improved Reading and Globe; the skin is brownish-yellow in colour, and the bulbs keep sound for an extraordinary time. Seed may be sown both in spring and autumn. Two very fine specimens of this Onion weighed 2 lbs. 13 ozs. and 2 lbs. 5 ozs. respectively.

Trebons.—Large, obovate, with a rather gross neck, the skin pale-straw colour, peeling off readily; flesh pale and soft, but of mild and good quality. A large and handsome early autumn sort, allied to White Spanish and Yellow Danvers, but does not keep well.

Tripoli.—Very large, tapering sometimes abruptly from the middle to the neck, and almost equally so to the root; colour beneath the skin pale brown-red, tinged with green. It is of a soft nature, and does not keep long, but is much esteemed on account of its mild quality. Giant White Tripoli is a flat pure-white form. It attains a very large size if sown early in autumn and transplanted in spring. Giant Rocca, with very large roundish-obovate bulbs, appears to be another fine form of Tripoli. One form is straw-coloured or light-brown, and the other deep-red and very mild flavoured. By sowing in autumn and transplanting, bulbs of 3½ lbs. have been grown.

Veitch's Main Crop.—A fine variety of the Improved White Spanish type. It is very quick in growth, and when fully developed attains a large size and heavy weight, having a great depth of bulb, being high in the shoulders and full at the base; the bulb is smooth and solid, and of a beautiful pale-straw colour. Generally grown for a main crop; is an excellent keeper.

Welsh Onion (*Allium fistulosum*).—Quite distinct from the common Onion, inasmuch as it never forms a bulb, but develops offsets freely. A Japanese form, erroneously called the Japanese Leek, is remarkable for its very large size. (See fig. 127.) Its principal use is to furnish young Onions for salads early in spring. There are two forms, the white and the red.

Wethersfield Red.—Large, flattened or oblate, very even and regular; skin dull-red, peeling off freely, the inner coating light-purplish; flesh pure white. Of mild excellent quality, and a good keeper. The finest of all the red Onions.

White Spanish.—Very large, flat; skin loose, pale-straw, falling off and exhibiting a greenish-yellow coating; veins not tinged with red; flesh firm and solid, almost white, and of excellent quality, with a mild flavour. Keeps good till March; one of the best for early winter use. When grown in autumn and transplanted in spring, it attains a very large size. The Banbury and Nuneham Park forms of it are specially good.

Fig. 127.—"Japanese Leeks."

Yellow Danvers.—Allied to White Spanish; bulb middle-sized, roundish-oblate, firm, with a very slender neck; skin dark straw-yellow, not loose and exposing the flesh. A very fine variety and a good keeper.

The following is a classified list of the Onions exhibited at a Vegetable Conference held by the Royal Horticultural Society:—

(*a*) Flat. Type—*Anglo-Spanish*.
Colour, yellow to brown.

Anglo-Spanish.
Anglo-White-Spanish.
Banbury.
Brown Spanish.
Danvers.
Danvers Yellow.
Deptford.
Giant Zittau.
Globe Danvers.
Market Favourite.
Nuneham Park.
Rousham Park Hero.
Sandy Prize.
Strasburg.
Sulphur Yellow.
Sutton's Improved Reading.
Veitch's Main Crop.
White Spanish.
Yellow Vertus.

(*b*) GLOBE OR ROUND. Type—*Ailsa Craig*. Colour, yellow to brown.

Ailsa Craig.	James's Keeping.
BedfordshireChampion.	New Paramatta.
Brown Globe.	Pinesfield.
Cocoanut.	Southport Yellow.
Cranston's Excelsior.	Trebon's White Globe.
Golden Ball.	Wroxton Improved.
Improved Pinesfield.	

(*c*) TRIPOLI. Flat and Round.

Advancer.	Large Giant Rocca.
Giant Late White.	Large Round Madeira.
Giant Lemon Rocca.	Madeira or Globe.
Giant Rocca.	Red Italian.
Golden Globe.	St. Laurent.
Large Blood-red Italian.	Yellow Rocca.
Large Flat Madeira.	

(*d*) WHITE OR SILVER SKIN. Type—*Queen*.

American or Southport.	Selected White.
Carter's Silver Ball.	Silver Skinned.
Early White Naples.	White Lisbon.
Queen.	

(*e*) BLOOD-RED. Flat and Round.

Black Douglas.	Red Campion.
Blood-red.	Southport Red Globe.
Dobbie's Red.	

ORACH, or Mountain Spinach (*Atriplex hortensis*).—A hardy annual, native of Tartary. The leaves are used as a substitute for Spinach, and to correct the acidity of Sorrel. The plant will grow well in any soil; but the leaves are largest and most succulent in rich soils. The seeds may be sown any time from the end of February to September in drills 2 feet apart, thinning out the plants, when 3 or 4 inches high, to 20 inches apart in the row. Or they may be sown broadcast in a small bed, and the young plants transplanted to the above distances. A sowing in March, and one in June, for succession, will in general prove sufficient; but if in constant demand it must be sown more frequently, for it soon runs to seed. Where seeds are not to be saved the flowers should be pinched off, as the seeds are very light and easily carried by the wind; they should be gathered before they are ripe, and dried and shaken out upon a cloth. There are three varieties, namely, white, green, and dark-red.

OXALIS CRENATA (fig. 128).—A tuberous-rooted plant, a native of Peru, where it is cultivated under the name of "Oca." The tubers, which are produced in great abundance, seldom exceed the size of a hen's egg. They are covered with a smooth skin, and have numerous eyes, by which the plant may be propagated.

They possess a somewhat acid taste, which is rather disagreeable; but it may be removed by adding a little carbonate of soda to the water in which they are boiled.

According to Mr. Weddell, the Oca is extensively cultivated in the temperate parts

Fig. 128.—Oxalis crenata.

of Bolivia, where several varieties are distinguished. The slightly acid flavour of the tubers is then removed by exposing them to the sun, which converts the acid into saccharine matter. This phenomenon is analogous to what goes on at the ripening of most fruits. The Oca, when treated in this way, loses all trace of acidity, and becomes as floury as the best varieties of Potatoes. It should be exposed to the sun from six to ten days. In Bolivia this operation is performed in woollen bags, which appear to facilitate the conversion of the acid. To obtain this result the bags should contain no more tubers than are sufficient to form a thin layer within the bag. If the action of the sun is continued for several months the Oca becomes of the consistence and sweet taste of dried Figs; the tubers are then called "Caui." They are cooked by steam, being placed on a bed of straw, which keeps them from contact with the water over which they are cooked. In Bolivia, and more especially at La Paz, the Oca is cultivated to double the extent of the Potato.

The plant requires a light rich soil and a warm situation. It is propagated by sets like the Potato, or by cuttings, which easily take root. The sets should be planted on a hot-bed in March, and planted out in May, $2\frac{1}{2}$ feet apart, in rows a yard asunder.

PARSLEY (*Apium Petroselinum*). — A hardy biennial, native of South Europe. It appears to have been known to the ancients as a medicinal plant, and in the Middle Ages Charlemagne included it among the plants which he ordered to be cultivated in his gardens. It is said to have been cultivated in England in 1548.

Parsley is extensively used in stuffings, for

flavouring soups and stews, and as a garnish. The Fool's-Parsley (*Æthusa Cynapium*), a poisonous plant belonging to the same

Fig. 129.—Fool's-Parsley (*Æthusa Cynapium*).

natural order as the true Parsley, bears considerable resemblance to the plain-leaved variety of the latter, and dangerous mistakes sometimes occur in consequence. When eaten it produces nausea, numbness, and insensibility, and in some cases even death. It may, however, be readily distinguished from Parsley by the unpleasant smell of the leaves when bruised, by their being of a much darker green, and of a different shape. It is further and more certainly known by having three long narrow leaves hanging down from one side of each of the partial umbels, as in fig. 129.

Parsley requires a good but not too rich soil, and a somewhat shady situation. It is raised from seeds, which may be sown any time between February and the end of August. A sowing in January or February, another in April or May, and one in July for winter and spring use, will in general suffice. The last sowing should be made at the foot of a south wall, and the plants ought to be covered with hand-glasses in frosty weather.

The seeds should be sown in drills 1 foot apart, and covered with fine mould to the depth of about ½ inch. They take a month or more to germinate. In dry weather the seed-bed should be frequently watered; and when the young plants are sufficiently strong they may be thinned out, first to 3 inches apart in the row, and afterwards, when rather further advanced, to 6 inches from each other. Parsley is frequently grown as an edging, but in this way, wherever there is much traffic, the leaves are liable to get bruised and dirty. In gathering for use, the largest and best leaves are picked off singly. When the leaves become old and no longer tender, the plants should be cut over, and fresh ones will be produced. This may also be done in autumn as a preparation for a winter supply. In frosty weather some plants should be protected with fern or litter.

Parsley transplants readily, and this admits of a considerable number of strong plants being lifted with their thick tap-roots intact, and replanted somewhat thickly in pits or frames in the autumn, or they can be placed in deep boxes or large pots, and in either case be well protected from severe frosts and be gathered from during the winter. The finest curled or "double" strains are more tender than the old strains, and are liable to be destroyed wholesale by severe frosts. If from this or other causes there is likely to be a failure in the supply in the spring and early summer months, prepare a gentle hot-bed in a pit or frame, on this place 6 inches of fine loamy soil, sow the Parsley seeds in drills or broadcast, and cover with ½ inch of sifted soil. Keep close till the seedlings are up, then give a little air. Thin out lightly, and when large enough thin out more freely, the thinnings being dibbled out on a warm border 12 inches apart each way to attain their full

Fig. 130.—Hamburg Parsley.

size, and give numerous gatherings of leaves far ahead of any plants that can be raised wholly in the open. Leave some of the plants in the pit or frame about 5 inches apart each way, and from these early and frequent gatherings of young leaves will be had.

In saving seeds, the plants with the most

Fig. 132.—Parsnip—Student.

perfectly curled leaves should be selected, and transplanted into an open spot of ground by themselves. The seeds ripen in July, and preserve their vegetative powers for two or three years.

Hamburg Parsley (fig. 130) is cultivated only for its edible fleshy roots. In order to have these large, the ground should not be too highly manured, but it ought to be

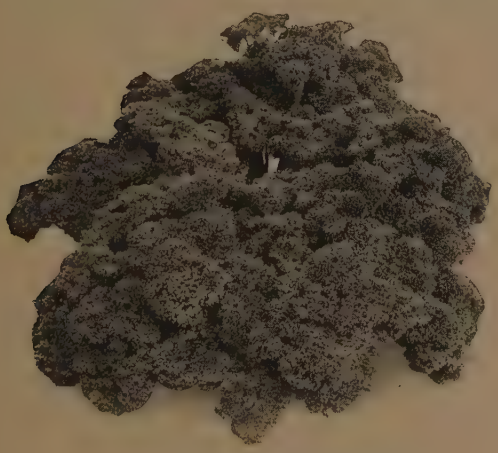

Fig. 131.—Parsley—Dwarf Perfection.

deeply trenched. The seeds are sown early in March, in shallow drills 1 foot apart, and the plants thinned out to 10 inches asunder in the rows. In October or November the roots, having attained their full size, are taken up and preserved in sand, or kept in earth in a border.

There are numerous named sorts of Parsley, but they differ only slightly from each other. Those most preferred have large very curly leaves, of which fig. 131 is typical.

PARSNIP (*Pastinaca sativa*).—A hardy biennial, native of Europe, including Britain. It is largely cultivated for its roots, which are very nutritious. A tolerable wine is also made from them.

The Parsnip is of more value as an article of food than is commonly supposed. It contains about 17 per cent of dry matter as compared with about 12 per cent in Swedes, 13 per cent in Carrots, and 25 per cent in Potatoes. The dry matter of Parsnips differs from that of Swedes and Carrots in containing an appreciable proportion of starch, thus resembling the Potato. The food value of Parsnips is about three-fourths that of Potatoes.

The Parsnip succeeds best in a rich deep soil and an open situation; a free sandy loam is also well adapted for its growth. The ground should be trenched and manured if necessary in the autumn, as the addition of fresh manure just before sowing causes the roots to fork. The seeds should be sown thinly, in the middle of March, in shallow drills, 15 inches, or not more than 18 inches apart. When the plants are about 2 inches high they may be thinned to 1 foot apart, or 15 inches if very large roots are desired. As a rule, medium-sized to comparatively small roots are preferred, these also being the least liable to canker. They can be had by leaving the plants 10 inches apart. With the exception of hoeing the ground, nothing further will be required

till the leaves begin to decay at the end of October or beginning of November, when a portion of the roots may be taken up and stored in dry sand for use in frosty weather; but as they are always best when newly dug, the principal portion should be allowed to remain in the ground, to be taken up for use as required. The remainder may be taken up in February before they begin to shoot, and stored for use. These will keep till April or May in a dry cool place. The Parsnip-fork (fig. 133) will be found very useful for taking up Parsnips, Carrots, and other roots.

Fig. 133. Parsnip or Root Fork.

If seeds are to be saved, some of the best roots should be carefully taken up and replanted 2 feet apart in a sheltered situation, where they will flower in July and ripen seeds in the end of August. Seeds more than one year old seldom germinate.

The varieties of Parsnip are :—

HOLBORN MARROW.—Roots just the size that a Parsnip should be, of first-rate quality.

HOLLOW CROWN.—Leaves short; roots 18 inches long, 4 inches in diameter, hollow round the insertion of the footstalks, the crown generally below the surface of the ground. When well-grown they sometimes weigh as much as 5 lbs., and in quality they are excellent, being tender and of fine flavour. The best variety for general cultivation.

STUDENT (fig. 132).—Roots 3 to 4 inches in diameter at the shoulder, thence tapering regularly to the depth of 20 or 30 inches. Crown generally below the surface of the ground.

TENDER AND TRUE.—Not quite so large as Student, but more perfect in form, the quality is the very best, and the skin beautifully clear and smooth. In the opinion of competent judges, this is the finest Parsnip in existence.

TURNIP-ROOTED.—Roots resembling a round Turnip, from 4 to 6 inches in diameter, and terminating in a strong tap-root. It is the earliest sort, and from the root growing principally above-ground, it succeeds well in ground too shallow for the other kinds.

PEA (*Pisum sativum*).—This should be known as the Garden Pea, to distinguish it from the Field Pea (*P. arvense*). The latter is grown largely for its haulm, highly esteemed as fodder, and differs from the Garden Pea in being hardier, purple-flowered, and in having brown-red or brown-speckled seeds.

The Garden Pea is an annual, with climbing slender hollow stems, and soft green pinnate leaves, terminating in tendrils which cling readily to bushes, &c., enabling the plant to climb. The stem varies in length from 6 feet or more, when it branches freely (fig. 134), to about 9 inches (fig. 135). The flowers, which are white and usually in pairs, begin to develop early, and fruits are usually abundant. There is much variety in the size and shape of the fruits (pods), and also in the seeds, which are either wrinkled or smooth, and cream-white or pale-green when ripe. It was cultivated

Fig. 134.—*Pisum sativum*, tall form.

for its edible seeds over two thousand years ago. Its botanical name, *Pisum*, is derived from Pisa, a town once famous for its Peas, and the popular name is from the same word—Pea, Peas, or, as Gerarde has it, "Peason." Its origin is unknown, beyond that it is probably Asiatic, and that it is certainly an introduced plant in Europe. Peas are said to have been an important crop in England in the eleventh century. "Before the introduction of the Potato, Peas were largely eaten by the working-

classes, and a food so rich in nitrogen was doubtless the cause of the superior muscular development among the peasantry. So important was this crop held to be, that in the letting of a farm the proportion of 'Siddan' land (Pea land) was always taken into consideration."

According to Gerarde there were numerous varieties of Peas in cultivation in England in the latter part of the sixteenth century. In 1710 mention is made in Salmon's *Herbal* of the following "Pease":—Early or Fulham, Green and White Hastings, Rounceval, Grey, Spotted, and "Peas without skins."

The end of the eighteenth century was an important era in the evolution of the Garden Pea. In 1787 Mr. Thomas Andrew Knight, President of the Royal Horticultural Society, made some experiments in crossing different forms of Peas, including one, "a white Pea, which possessed the remarkable property of

Fig. 135.—*Pisum sativum*, dwarf form.

shrivelling excessively when ripe." From these he obtained Knight's Green and White Wrinkled Marrow Peas. Writing in 1817, he said, "The Pea which I have always planted for autumnal crops is a very large kind, of which the seeds are much shrivelled, and which grows very high: it is now very common in the shops of London, and my name has, I believe, been generally attached to it. I prefer this variety because it is more saccharine than any other, and retains its flavour late into the autumn." This was Knight's Tall Wrinkled Pea, afterwards sent out as British Queen.

In 1850, Dr. Maclean of Colchester commenced to cross-fertilize Peas. He raised numerous first-rate sorts, which were distributed by Turner and Veitch. Among them was Veitch's Perfection, which has held its place ever since as one of the best medium-height wrinkled Peas in cultivation. Without doubt it is a descendant of Knight's Dwarf Green Wrinkled. Little Gem, also raised by Maclean, was the first dwarf wrinkled Pea.

Other successful raisers of first-rate Peas were Mr. T. Laxton, Mr. Culverwell, and Mr. Eckford. Messrs. Sutton & Sons have introduced many excellent sorts of Peas, including Perfection, Late Queen, Excelsior, Centenary, &c. Messrs. Carter & Sons also have distributed many good Garden Peas, including Sherwood, Edward VII., Surprise, Quite Content, &c.

The cross-fertilizing of the flowers of Peas is an operation requiring much care, that is, if a cross is to be obtained, many supposed crosses being nothing more than the result of self-fertilization. The following directions were given by the late Mr. N. N. Sherwood:—

The flower of the variety selected as the seed parent should be secured some time before it approaches the opening stage, as, if not operated upon at the right time, it may become self-fertilized. Having selected the two varieties of Peas to be crossed, the operator carefully opens the undeveloped petals of the seed parent, removing delicately and carefully by means of forceps the undeveloped anthers upon which appear the pollen grains, but which at this stage are not active. The next process is to take the other bloom selected just as the pollen grains are maturing upon the anthers, and by the assistance of a fine camel's-hair brush carefully dust with pollen the stigma of the seed-bearing blossom; when the viscid substance upon the stigma dissolves the pollen grains they pass into a tube below, the lower end of which is connected with each ovule contained in the ovary; and as the dissolved grains pass into the ovules fertilization is completed.

The operation thus performed, the operator carefully covers up the stigma with the petals of the flower to prevent contact by the elements, or by insect agency, &c., and the fertilized blossom is covered with a thin piece of muslin or cotton shading.

The act of crossing has been performed with marked success, and the changes thus brought about will manifest themselves in successive generations. Supposing a fertilized pod produces six seeds, and if each of the six seeds be sown and they germinate, and the produce of each of the six seeds be sown by themselves, it is pretty certain each row, though sown with seeds which are the produce of an undivided plant, would produce plants showing great diversity in habit of growth, earliness, and in the char-

acter of the pod and seeds. As a general rule, after reaching this point it is necessary to select the most promising plant in each of the six rows, and by succeeding selections fix the character of the particular variety. It very likely happens that the best type obtained from a particular cross is found in selections made in the fourth and fifth year after the cross was made.

Cultivation.

Soil.—For the main crop of Peas a rich friable loam is best, in the composition of which lime is a principal ingredient; and if the soil does not naturally contain a sufficiency of calcareous matter, the latter should be added to it in the shape of lime, chalk, gypsum, &c. It should be deep, so that the roots may easily penetrate downwards to obtain moisture in time of drought, as, if the plants once get too dry after they have commenced to blossom, the pods never fill well. For early crops, and especially for the very earliest, a warm, rather sandy loam is desirable, because earliness rather than abundance is the desideratum. The ground in all cases should be well drained, and the surface should be kept so that the rain-water may pass through the soil.

Manure should be applied in greater or less quantity, according as the soil is more or less poor. In general, Peas are sown in ground that has been manured for a previous crop; but for the latest crop it is a good plan to trench the ground, putting a layer of rotten dung about 1 foot below the surface. For early crops horse-dung is preferable, and in moist situations it may be employed in a littery state when only partially decomposed, so that it may act mechanically as drainage. When the soil has not been enriched for a previous crop, and is too poor for Peas, farmyard manure can always be depended on. Blood is an excellent manure for Peas. It may be applied fresh and watered in, or in a dried state and forked into the rows.

With regard to artificial manures, the natural composition of the soil should be ascertained, and if possible substances of which it is deficient should be supplied. In calcareous districts it would, of course, be worse than useless to add lime, chalk, or gypsum; but these substances will, on the contrary, be highly beneficial in all soils where they only exist in very limited quantity. Some artificial manures act injuriously when they are in immediate contact with the germinating seed, and the seed itself doubtless affords the best nourishment that can be given, and till that is exhausted, or nearly so, stimulants of any kind must be either superfluous or injurious. Guano, however, has been found to answer well when mixed with the soil in the bottom of the drill, and then covered with 1½ or 2 inches of soil. When at this distance from the pushing embryo the latter cannot be injured by the manure, and the radicle, when it approaches it, is strong enough to assimilate the nourishment thus afforded. Excellent crops have been obtained with guano applied in a similar manner, and the haulm was shorter and stronger than where no guano was employed; but on Marrow Peas, which are naturally inclined to grow too luxuriant, the effect as regards produce was not so good.

The ground having been prepared, the first thing to be done is to mark the distances for the rows, and this will depend on the height of the variety, which again ought to be selected according to circumstances. Where the space is limited, or where tall sorts would injuriously shade other things, it may be advisable to select dwarf kinds, or at all events not very tall ones. It has been well ascertained that rows standing far apart yield the best and most abundant produce. Hence, some have them 20 or 30 feet apart or more, the intermediate space being occupied by other crops. The usual plan, however, is to make the rows from 3 to 6 feet asunder. The very dwarf sorts, not requiring sticks, such as Harbinger, Chelsea Gem, and Sutton's Green Gem, may be sown in rows 2 feet 6 inches apart; and, as a general rule, the distance between the rows may be made equal to the height to which the variety usually grows, taking into consideration the nature of the soil. The vigorous-growing dwarf Marrows require more space than the slender-growing kinds. Duke of Albany, Alderman, Gold-finder, and Ne Plus Ultra should have not less than 6 feet of space between the rows, unless space is very limited, and then the distance may be a foot or so less, taking care, however, to top the plants when 5½ or not more than 6 feet high.

First Early Peas.

For early Peas, the best direction for the rows is east and west. This would be lengthwise along a south border; but it is generally more convenient to sow across the border, and if it be done obliquely from south-east to north-west, the ridge of soil

drawn to the roots of the plants will have the sun's rays nearly direct on its broadside when they are hottest.

For the main crops in the open quarters it is best to sow the rows from north to south. The average depth of the drills should be 2 or 3 inches for small sorts, and 4 inches for the large kinds. Instead of drawing the drills so as to form a triangular furrow, make them wide and flat at bottom, say 7 inches wide, or at all events not less than 6 inches ; the roots will thus have room to grow without being crowded, and without robbing each other of nourishment and moisture.

raised in forming the drill should be made fine and drawn over the seeds, and trodden lightly.

As soon as the plants are a few inches above-ground a little earth should be drawn towards the lower part of the stem, but so as to press very little against the foliage. As the plants advance, some more soil should be drawn towards them. Sorts that require support should then be immediately staked, for it is unwise to allow the plants to grow till the haulm bends. By the time the tendrils appear, the sticks should be in readiness for them to lay hold

Fig. 136.—A good crop of Gradus Pea.

The seeds are often sown too thickly ; on the other hand, some direct them to be placed as much as 3 inches apart. This, however, can only be recommended when the object is to have as much increase as possible from some particular sort. The seeds should be tried previous to sowing, and allowance made for the proportion of it that either fails, or germinates so weakly as not to be reckoned upon. Early sorts, if the seeds are good, may be sown at the rate of a pint for a row 50 feet long. Late strong kinds, such as the tall Marrows, may be allowed for 70 or 80 feet per pint.

When the seeds have been sown, the soil

of, and then they will keep the haulm straight, which is more than can be effected by any propping up after it has been bent. For sorts that do not require stakes, the soil should be drawn more against one side of the row than the other. This will incline all the haulm to the opposite side. Were this not done, some plants would incline one way and some the other, and get into confusion with those in the adjoining rows. It is better to incline the plants when young, than allow them to grow to some considerable height, to be blown over by the wind.

Peas for market are generally grown in open fields entirely without stakes, medium-

height sorts being preferred. The seeds are sown thinly in lines 2 to 2½ feet apart. When the plants are high enough they are simply moulded up as for Potatoes. In this way good profitable crops are obtained.

Earliest Crops.—It was formerly an aim in Pea culture to have the first gathering as early as the 4th of June, the birthday of George III. But by various modes of forwarding and protecting, new Peas are obtained much earlier in ordinary seasons. To have them, however, in the first week in June is early enough when means are limited. There may be a south sheltered border at disposal, in which the first sowing for an early crop may be made about the middle of November, choosing, of course, the earliest sorts, and enough of each to afford a dish, by taking the one or two most forward pods on each plant.

As a protection from mice, the seeds should be planted deeper than is usual for summer crops; but the nature of the covering should be lighter. The young plant will push its way through a considerable depth of soil without injury. The seeds as soon as sown may be covered with some good soil, and then with several inches of sand. The sand would be easily enough worked by mice, but it forms too unstable a roof for their burrows, and by falling in renders their mining operations in vain. Chopped furze has been employed, but it is not quite effectual; for mice live snugly enough under furze bushes where old fallen prickles abound. Moistening the seed and then rolling it in powdered red-lead is by far the best preventive of mice attacks. It does not affect the germinating powers of the seeds, whereas petroleum is liable to do so, and, in addition, acts as a preventive for a short time only.

Before the young plants are well through the soil, it should be stirred and made fine, taking care in doing so not to injure them. When they are a few inches high the soil should be drawn against them, and they ought to be sheltered by sticks, stronger, and placed closer together, on the north than on the south side. On the latter, indeed, the sticks should be as thinly set as is consistent with preventing the plants from falling, till their tendrils can lay hold of the more substantial sticks, intended for both shelter and support. In quarters, and sometimes in borders, the ground for early-sown Peas is thrown up in ridges, the bases of which are equal to the distance which the variety would require between the rows, if sown on level ground. Their height may be 2 feet above the bottom; the latter should be made lower at one end than the other, in order that water may not collect in it. In this way the roots of the plants will be free from excessive water; whilst the Peas, being sown about half-way up the slope, will be sheltered by the upper part of the ridge. If the weather and state of the ground permit, another sowing should be made in January, still choosing a warm sheltered situation.

Early dwarf Peas are occasionally sown in the shelter of walls; but it is better not to do this if any other means can be adopted, because the Peas interfere with the performance of operations necessary for wall-trees. The wooden pales of any enclosure, not immediately connected with the garden, may be taken advantage of, and various other means of shelter may be devised. In case of severe frost it is a good plan to mulch the Peas with litter, leaves, or other substances that will prevent the ground from being frozen.

Sowing in Pots.—Where pots can be spared for the purpose, they afford a very convenient means of forwarding an early crop, as they can be easily moved from place to place, and exposed to air and light. Various modes of sowing in pots have been recommended. Some dispose the seeds in a circle by the side of the pot, and in planting out, the ball is opened so as to allow of the circle of Peas being extended along the drill. In this way the plants started in an 8-inch pot would occupy nearly 2 feet of row. We, however, prefer pots about 3 or 4 inches in diameter. In these the seeds should be sown equally, but not too thickly, and reared in a house or frame, but in all cases near the light, till the weather is fit for them to be planted outside.

Mild weather should be chosen for this operation, and it would be desirable that the wind should be in the south-west, for in that case there would be little danger of frost at night. If turned out of the pots, and planted by means of a trowel, with the balls entire and about 1 foot apart, and the plants immediately staked, the latter will fan so as to fill the rows better even than if the balls were broken and extended so as to meet each other in the drill. A few spruce branches may be stuck in on the northern side for additional shelter. The plants should be earthed up in the usual way, and stopped above the third or fourth flower.

Turves are sometimes substituted for small pots, and early Peas also move well

out of large flat boxes in which they have been raised thickly. They may be shaken out and planted in deep narrow trenches, much as box edging is planted.

The Parisian market-gardeners sow in the beginning of November, in frames, placed on a border with a south aspect. They allow about 1¾ pint of seed to 52 square feet, and this produces plants sufficient for six or eight frames of that area. The seeds are covered very slightly; the sashes are put on, and when the plants have begun to push they are covered with a thin layer of fine earth. In the course of December the frames into which the young plants are to be transplanted are prepared, and the ground inside is dug out so as to be 18 inches below the sashes, the earth removed being placed against the outside of the frames. After this the ground on the inside is dug, levelled, and raked, and four drills

Fig. 137.—Pea—Gradus.

3 inches deep are drawn lengthwise in each frame at equal distances; but a greater space should be given between the first row and the front of the frame than that allowed between the rows themselves, because that part is naturally the dampest.

As soon as the young plants are 4 inches high they are taken up without breaking the roots, and planted in patches of three or four, placed 8 inches asunder in the row. During frost the sashes are covered at night with straw-mats, and air is given whenever the weather is sufficiently mild. When the Peas are 9 inches high all the stems are inclined towards the back of the frame, and to keep them in this position a little soil is drawn to their base. When they come into blossom they are pinched above the third or fourth flower to make them fruit sooner.

Whenever the sun has sufficiently warmed the ground, water is given, but only very sparingly till the plants begin to pod, otherwise a too vigorous growth, which would be detrimental to the crop, would be the result. Usually plants thus treated produce pods fit for gathering in the first fortnight in April.

Although every possible care may have been taken to protect winter-sown Peas from accidents, the ravages of mice, birds, and other enemies, it frequently happens that the rows have many blanks; it is therefore a good plan to sow some in a frame for the purpose of filling up vacancies.

In the climate of Britain it rarely happens that the temperature is not above freezing point during some period of each day in winter; and Peas, when the plants are young, will bear several degrees of frost without injury. They may, therefore, be forwarded in any place where they can be protected at night, and that will be sufficient. They should be exposed to the open air and light on every favourable day for at least a short time to maintain the foliage in a green state, and induce a daily advance in growth.

If frames are not at command, turf-pits could in many cases be formed with rods or slender poles laid to support thick straw-covers, fitted so as to be easily rolled up or unrolled. Or the seeds might be sown in large pots, a branched twiggy stick, as tall as the plants are intended to be grown, being at the same time firmly inserted in the centre of the pot. Instead of this stick, Mr. Wilson employed moderately strong willows, inserted at the sides of the pot, with courses of small twine run round the willows and at 6 inches apart. The advantage of this mode is, that the plants can be kept in the pots till the produce is obtained, and previous to that they can be moved to where there is light and a sufficient amount of heat. Peas, when young, will not bear forcing till they are out of bloom and the pods set; then they will bear it and be forwarded by it.

Main Crop and Late Peas

The sowings for the main crops should be made in March, April, and May, at intervals which must vary according to the variety employed and other circumstances. Many sow for succession when the previous sowing appears above-ground; but this rule should not be made absolute. For example, a sowing made when the weather is very favourable for vegetation, and on the first appearance of the previous sowing, will almost overtake it, and thus form too close a succession. If sorts are employed that do not naturally form a succession, the sowings will require to be made at intervals of a fortnight or three weeks. The periods which the respective varieties require from the time of sowing till they come into bearing varies, of course, in different seasons and localities, so that the only way by which a correct knowledge as to those which will naturally form a succession can be acquired is to try the different varieties, and note the order in which they become fit for use, and then it will be easy to regulate the sowings so as to keep up a succession. By selecting proper sorts, and adopting a suitable mode of cultivation, Peas may be obtained until late in autumn.

The soil should be well and deeply trenched, and if dry it should be thoroughly moistened, particularly the lower portion of it, otherwise the crop is apt to mildew. The ground being so far prepared, shallow trenches should be dug out as for Celery, and some good rotten dung laid in the bottom. Part of the soil turned out of the trench ought to be scattered over the dung, then a layer of dung and soil mixed; finally, a layer of soil without manure, and in that the seed should be sown. The best sorts for a late crop are the Wrinkled Marrows. In warm soils and situations these may be sown in the second or third week in June; but in the northern parts of the kingdom the first week will be as late as they will blossom and form pods in any quantity. The tall sorts for late produce should be topped when 4 feet high, and again when 6 feet. Harbinger and Chelsea Gem may be sown as late as the middle of July to afford a late supply, as they form pods in a shorter period from the time of sowing than the Marrow kinds.

The plants raised from these sowings should be earthed up and staked in the usual way, and care should be taken that the roots are supplied with moisture. If the air be hot and dry, the drain of moisture from the soil by the roots will be very great, so that before one is aware the soil is dry, and then the plants must suffer. If once too dry the evil cannot be effectually remedied, whereas it may be easily prevented by timely watering. If the weather continue dry, a good mulching with dung and leaf-mould will be very beneficial.

It is not natural, however, for Pea-seeds to germinate in the hottest period of the season, and then to have to grow, flower, and form seeds under a great decline of temperature. They succeed best when sown so that they may progress towards maturity with a rising temperature. Therefore it is probable that to obtain good late Peas with certainty would be to sow in pots in July, and keep the plants in a rather cool place till they had nearly advanced to a flowering state, and then remove them to a warmer situation, such as that in front of a south wall, where they could be protected if need be. In this way they would be kept comparatively cool during the early period of their growth; and although the heat would decline as they advanced to flowering, yet to them the effects would be in a great measure counteracted by a removal from a cool to a warm aspect, where the plants would be exposed even to an increase of temperature compared with that in which they had been reared.

To save Seeds.—In order to have well-matured seeds, the crop should be sown at the most favourable period for the uniformly progressive growth of the plant, and the best time for this is March. The very early sorts are more apt to be attacked by insects than later kinds, which are supposed to escape on account of their not coming into flower till the insect has changed. On this account it may be advisable, where early sorts are liable to be attacked, to sow them later, so that they may not come into flower when insects are abundant.

Enemies.—Pea and Bean Weevils (*Sitona crinita* and *S. lineata*), Bean Beetle (*Bruchus granarius*), Pea Moth (*Endopisa proximana*), Mildew, Birds, Mice. See chapter on this subject.

Selection of Varieties

Although the varieties of Peas are very numerous, reputed new ones are eagerly sought for. Whilst this is the case, new names will doubtless annually appear in the seed lists, though the varieties to which such names are applied may not be distinct from some already known. The most

stable of varieties may be grown under particular circumstances of soil and situation, and may in consequence be altered in character, an alteration, however, of only temporary duration; yet this is sometimes seized upon as a "new break," and sent out under a new name.

The following are of proved first-rate quality:—

First Early, Dwarf.

CHELSEA GEM.—About 15 inches high Pods usually in pairs of moderate length, slightly curved, containing five to seven seeds, which are wrinkled and of first-rate quality and flavour. Sown March 7, fit for use June 17. Very heavy cropper.

EXCELSIOR (Sutton's).—About 18 inches high. Pods usually single, long and straight, containing seven to eight large seeds, which are compressed, wrinkled, and of first-rate quality. Sown March 7, fit for use June 16. Heavy cropper.

GREEN GEM (Sutton's).—About 15 inches high. Pods single, long, broad, and straight, containing seven to ten large seeds, which are very dark green, compressed, wrinkled, remarkably sweet, and of fine quality. Sown March 7, fit for use June 14. Heavy cropper.

HARBINGER.—About 15 inches high. Pods usually single, long, straight, containing six to nine seeds, which are large, compressed, wrinkled, and of the finest quality and flavour. Sown March 7, fit for use June 11. Heavy cropper.

LITTLE MARVEL.—About 24 inches high. An extraordinary cropper. Pods dark, of medium size, flavour good.

THE SHERWOOD.—About 18 inches high. Pods usually in pairs, moderate length, straight, containing five to eight seeds, which are large, compressed, wrinkled, of fine quality and very sweet. Sown March 7, fit for use June 24. Very heavy cropper.

First Early, Tall.

EDWIN BECKETT.—About 4 feet high. Pods usually in pairs, large, straight, containing seven to nine seeds, which are very large, of fine quality and delicious flavour. Sown March 20, fit for use June 20.

BOUNTIFUL.—About 4 feet high. Pods usually single, long, straight, containing six to nine seeds, which are large, compressed, round, of an excellent sweet flavour. Sown March 7, fit for use June 17. Very heavy cropper.

EARLY GIANT.—About 4 feet high. An abundant cropper, large handsome pods, of the finest quality. Sown in March, fit for use in June.

DUCHESS OF YORK.—About 4 feet high. Pods usually single, large, straight, containing seven to nine seeds, which are very large, compressed, wrinkled, of the finest quality and flavour. Sown March 7, fit for use June 18. Heavy cropper.

GRADUS (fig. 137).—Height about 4 feet; haulm stout; pods light green, usually in pairs 3 inches in length, averaging five large peas in each, wrinkled. Sown first week in April, ready to pick third week in June. One of the very best peas.

IDEAL (Sutton's).—About 3 feet high. Pods usually single, large, straight, containing six to nine seeds, which are large, compressed, wrinkled, of the highest quality and flavour. Sown March 7, fit for use June 9. Extraordinary heavy cropper.

MAY QUEEN.—About 3 feet high. Pods usually single, large, broad, and straight, containing five to eight seeds, which are large, very compressed, wrinkled, of first-rate quality and flavour. Sown March 7, fit for use June 9. Heavy cropper.

Second Early and Early Main Crop.

CENTENARY (Sutton's).—About 5 feet high. Pods usually in pairs, very large, straight, containing six to nine seeds, which are large, moderately compressed, wrinkled, of high quality and excellent flavour. Sown March 20, fit for use June 29. Heavy cropper.

Fig. 138.—Pea—Quite Content.

DAISY.—About 2 feet high. Pods usually in pairs, large, straight, containing five to nine seeds, which are large, compressed, wrinkled, of fine quality and flavour. Sown March 20, fit for use July 2. Heavy cropper.

DUKE OF ALBANY.—About 5 feet high. Pods usually in pairs, long, large, straight, containing eight to ten seeds, which are large, compressed, wrinkled, of first-class quality and flavour. Sown March 20, fit for use June 27. Very heavy cropper.

QUITE CONTENT (fig. 138).—About 5 feet. The largest and best podded Pea in cultivation. Pods usually produced in pairs, containing nine to ten seeds, which are of superb flavour. Sown in March, fit for use about June 20.

PRIZE WINNER.—About 3 feet high. Pods usually in pairs, long, broad, straight, containing eight to eleven seeds, which are large, compressed, wrinkled, of the finest quality and flavour. Sown March 20, fit for use July 2. Very heavy cropper.

STRATAGEM.—About 2½ feet high. Pods usually in pairs, large, straight, containing seven to ten seeds, which are large, very compressed, wrinkled, of excellent quality and flavour. Sown March 20, fit for use June 30. Very heavy cropper.

Main Crop and Late.

ALDERMAN.—About 5 feet high. Pods usually in pairs, large, long, straight, containing eight

Fig. 139.—Pea—Late Queen.

to ten seeds, which are large, compressed, wrinkled, of very fine quality and flavour. Sown April 5, fit for use July 7. Very heavy cropper.

AUTOCRAT (Veitch's).—About 4 feet high. Pods usually single, moderate length, containing five to seven seeds, which are large, very compressed, wrinkled, of the finest quality and flavour. Sown May 1, fit for use August 9. Very heavy cropper.

CAPTAIN CUTTLE.—About 4 feet high. Pods in pairs, long, slightly curved, containing eight to ten seeds, which are large, compressed, wrinkled, of the finest quality and flavour. Sown April 5, fit for use July 12. Very heavy cropper.

CONTINUITY.—About 4 feet high. Pods usually in pairs, long, straight, pointed, containing five to seven seeds, which are large, very compressed, wrinkled, of fine quality and flavour. Sown May 1, fit for use August 10. Very heavy cropper.

EDWARD VII. (Carter's).—About 3 feet high. Pods usually in pairs, long, straight, containing five to eight seeds, which are large, very compressed, wrinkled, of first-class quality and flavour. Sown April 20, fit for use July 30. Very heavy cropper.

EXHIBITION (Carter's). — About 5 feet. Wrinkled marrow-fat. Main crop, seed large, green, and wrinkled, a splendid exhibition variety. Pod of a dark rich colour. Sown April 10, fit for use July 15.

LATE QUEEN (fig. 139).—About 4 feet high. Pods in pairs, moderate length, straight, containing five to seven large seeds, which are compressed, wrinkled, of very good quality and flavour. Sown May 8, fit for use September 1. Heavy cropper.

MICHAELMAS (Carter's).—About 4 feet high. Pods in pairs, moderately short, containing five to seven seeds, which are large, compressed, wrinkled, of fine quality and flavour. Seeds sown May 8, fit for use September 5. Heavy cropper.

NE PLUS ULTRA.—From 6 to 7 feet high, with a strong robust branching stem. Pods from twelve to eighteen on a stem, almost always in pairs, olive-green, very plump and full, containing from seven to nine very large seeds of first-rate quality. Sown May 1, fit for use August 15. One of the very best and most productive.

PERFECTION.—Height 3½ feet; a robust grower and a grand cropper. Pods in pairs, long, straight, containing nine or ten large compressed seeds of excellent flavour, and a dark-green colour when cooked. Sown May 1, fit for use August 20.

SHARPE'S QUEEN.—About 3 feet high. Pods usually in pairs, large, straight, containing six to eight seeds, which are very large, compressed, wrinkled, of excellent quality and remarkably sweet. Sown April 20, fit for use July 27. Very heavy cropper.

THE GLADSTONE.—About 5 feet high. Pods usually in pairs, long, nearly straight, containing eight to eleven seeds, which are very large, compressed, wrinkled, of superb quality and flavour. Sown May 1, fit for use August 8. Very heavy cropper.

POTATO (*Solanum tuberosum*).—A perennial with tuber-like stems, popularly known as tubers, native of Peru, Colombia, Chili, and possibly Mexico. It is said to have been first introduced into Europe about 1580 by the Spaniards, although the popular belief is that it was first brought by Sir Walter Raleigh in 1586 from Virginia.[1] Gerarde, the English botanist, certainly grew the Potato in his garden at Holborn in 1596. It was, however, only as a curiosity or delicacy that the Potato was then cultivated, for some reason a prejudice against its use as food prevailing for many years. In the eighteenth century it became better known and more cultivated in England; and in 1796 no less than 1700 acres in Essex

[1] See B. D. Jackson on "The Introduction of the Potato into England."—*Gardener's Chronicle*, 1900, xxvii. 161, 178.

were planted with Potatoes for the London market.

The following particulars of the cultivation and improvement of the Potato in Europe are from a paper by Mr. A. W. Sutton, F.L.S., the senior member of Messrs. Sutton & Sons, Reading.

Fig. 140.—Potato Flower.

It would be interesting to trace the steps by which the great improvement in the cultivated forms of the Potato has been brought about. Fortunately, in this instance the old rule that " like produces like " does not hold good ; for had the development of the Potato been restricted by such limitations, it is probable that our present supply would be similar in character to those of which Gerarde speaks. And here it is necessary to refer to a misunderstanding arising from the fact that " seed Potatoes " and " Potato seeds " are sometimes regarded as synonymous terms. " Seed Potatoes " are grown from perfectly true and reliable stocks, the crops being carefully examined year after year with the special object of ensuring the perpetuation, unmixed, of any given variety. Frequently the tubers of an ordinary crop, which are too small for market, are kept back for planting, and dignified with the title " Seed Potatoes."

I need scarcely remind you that Potatoes are mere enlargements of underground stems, shortened and thickened, in which starch is stored up in smaller or larger proportion according to the characteristics of the several varieties. Like other underground stems, the tubers possess buds or eyes, from which, by fresh shoots, the plant is capable of re-development ; and although the tubers may be preserved through the winter for planting again in the following spring, they are neither more nor less than portions of the plant which died down and apparently ceased to exist in the previous autumn. Hence the life of a single Potato plant may be prolonged year after year until through weakness or deterioration it comes to an end. It will therefore be obvious that improvement by selection of the tubers is impracticable. Any one can demonstrate this by planting a tuber which from any cause may be misshapen. The produce will revert to the uniform type of the variety to which it belongs. The only modification of this rule I am acquainted with is in the cases where *all* the tubers of one plant show a uniform divergence in character, either for better or worse. When this is so it is possible that, by the selection of all or any of these tubers, a slightly

Fig. 141.—Potato Fruits and Foliage.

different Potato might result, as in the case of some types of the Ashleaf section, which are dwarfer and more compact, or else taller and coarser-growing, than others. Outside the Ashleaf class, however, I know of no such instances. A really first-class seedling Potato is not liable to degenerate so quickly as is generally supposed. If degeneration sets in soon after its introduction, it merely proves that the variety is one which ought never to have been brought to public notice.

Raising Seedlings.—Potato seeds, on the

Fig. 142.—Potato Seedling.

other hand, are formed in the Potato berries which some, though not all, varieties of Potatoes bear freely (fig. 141). A berry may contain from 100 to 300 seeds, the average of five berries examined being 232, and as the parent plant appears able to control but slightly the distinctive character of its progeny, and as all the different seeds from one berry may produce plants differing from one another, not only in form, but many of them in colour also, it is here we find the great possibilities for improving the race by selection of the better seedlings. Even if no cross-fertilization of flowers was attempted, great improvement might be made by the selection of the most promising seedlings during the first few years of their existence; but where judicious crossing of the best-known varieties is undertaken we can in a great measure combine in some of the resulting seedlings the merits of both male and female parents, although even then no two seedlings from the same berry may be exactly alike.

Those who attempt to raise seedling Potatoes must possess patience. Like many other species which are not habitually multiplied by seed, the Potato has a remarkable tendency to revert to the wild form. It may be necessary to cultivate 100, or even 1000 seedlings, before finding one which is really worthy of a place amongst the better varieties already existing. M. Vilmorin says that in France the raising of seed Potatoes has been proceeded with in a somewhat haphazard manner; whereas in England, on the other hand, a more systematic method has been followed, richness in starch, excellence of flavour, power of resisting disease, with little tendency to develop haulm, being the characters we on this side the Channel generally seek. Unfortunately, he says, they are not always able to profit in France by progress realized in England, because the French have a marked preference for Potatoes with yellow flesh, whereas in England, for many years past, there has been a preference for white-fleshed Potatoes. On this account even the celebrated Magnum Bonum, which my house had the honour of introducing in 1876, after having enjoyed

Fig. 143.—Potato—An ideal kidney tuber.

a brief popularity in the Paris markets, has been almost abandoned as a table variety on account of the flesh being too pale in colour. M. Vilmorin remarks that in Germany considerable attention has been given to the raising of seedling Potatoes, and more particularly with the object of obtaining varieties which are specially adapted for the production of alcohol and starch.

Modern Introductions.—English Potato-

growers are indebted to the lifelong labours of such men as the late James Clark of Christchurch, Hants, who raised the following amongst other standard varieties (most of which I have myself been responsible for introducing) :—

Abundance,	Nonsuch,
Ideal,	Reliance,
Invincible,	Satisfaction,
Magnum Bonum,	Supreme,
Maincrop Kidney,	Sutton's Seedling,
Ninety-fold,	Windsor Castle ;

to the veteran Mr. Robert Fenn of Southampton, Berks, whose best-known seedlings are Ringleader, Early Regent, and Reading Russet ; to Mr. Shakeshaft of Lymn, Cheshire, who raised Harbinger, which has taken so prominent a place in Ayrshire ; and to Mr. Charles Ross, Mr. A. Dean, and others, whose attention has been chiefly devoted to the raising of garden Potatoes.

Credit is also due to Mr. A. Findlay of Markinch, for introducing one of the heaviest cropping Potatoes of the day, viz. Up-to-Date, as well as British Queen, Jeanie Deans, and Challenge ; and to Mr. C. Fidler of Reading, who has introduced Reading Giant, Colossal, and Queen.

Amongst other Potatoes which have taken a prominent place in recent years, as a result of hybridization [crossing], the following deserve mention :—

Arran Chief.	Kerr's Pink.
Beauty of Hebron.	Langworthy.
British Queen.	Schoolmaster.
Early Puritan.	Snowdrop.
Early Rose.	The Factor.
Great Scot.	The Lochar.
Golden Wonder.	The Saxon.
King George.	Victor.

Cultivation

Soil.—The best soil for the Potato is a good friable loam, rather light than otherwise, and free from stagnant water. In such soil the produce is abundant and the quality good. Thin sandy soils also produce well-flavoured Potatoes ; but of course to obtain quantity of produce the assistance of manure is necessary. The worst soils for the Potato are those which are naturally wet and heavy, and those which have long been cropped and heavily manured ; hence, garden ground in most cases does not produce tubers of so good quality as those obtained from the fields. It is therefore not advisable to occupy the garden with any but early kinds, if the general supply can be obtained from the fields. The soil ought to be prepared well in advance by digging it deeply and turning it up roughly so that the action of frost, &c., in winter may pulverize and otherwise improve it.

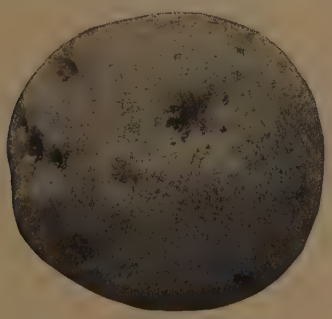

Fig. 144.—An ideal round tuber.

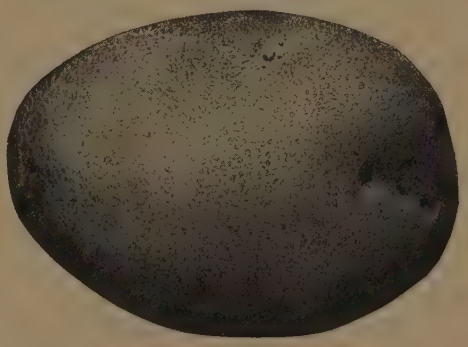

Fig. 145.—An ideal pebble-shaped or oval tuber.

Manure.—In good garden soil the less manure that is used the better flavoured will be the produce, and it will also be much less affected by disease.

Farmyard manure spread along the bottom of the furrows, and the sets placed upon the manure, is a very common practice. When dung is scarce and the soil poor, this method of application may be advantageously pursued, but in gardens the manure may be dug in equally. Long dung is good for moist, loamy soils, and fresh littery stable dung is suitable for early crops. Farmyard manure mixed with wood-ashes answer well, the ashes lessening the tendency to disease. Cow-dung is a more lasting manure than horse-dung, and is considered better for late sorts in warm, dry, sandy soils, as it retains more moisture. It should be well mixed with litter, and be placed below the sets, so as not to be in contact with the young tubers, otherwise it is apt to make them scab. The same remark applies to pigs'-dung, which should be either well mixed with the soil, or preferably formed into a compost with earth previous to planting.

Where the soil is damp and heavy a dressing of dead leaves is of advantage in keeping the ground open. They may be placed under or over the sets, or both, or distributed equally throughout the soil in digging; but they should be turned over and thoroughly wetted before they are dug in; for if turned into the soil in cakes, they are apt to remain in that state and become musty. Wood-ashes are useful for supplying potash and other inorganic substances required by the plant; and they may be advantageously applied where the soil contains a large amount of decayed vegetable matter The same remark will apply to lime, which is also useful in killing slugs and other vermin which attack the tubers. Gypsum, bone-dust, and superphosphate of lime are best for humid soils; they induce earliness, and where this is an object they may be applied with considerable advantage.

In the *Journal of the Board of Agriculture* for March 1901 there is a notice of some experiments made in the manuring of Potatoes by Mr. R. P. Wright. The experiments were conducted in Cheshire, Yorkshire, Northumberland, Durham, and the centre and south-west of Scotland. The chief object aimed at was to discover the cheapest and most effective method of manuring for Potatoes, but incidentally some valuable information was obtained on some other points of practical importance. One of these was that some varieties responded to the application of manures to a much greater degree than others.

In ordinary practice Potatoes are rarely grown except with applications of farmyard manure, to which artificial manures may or may not have been added. In the experiments there were plots to which farmyard manure alone was applied in the usual quantity; other plots to which, in addition to farmyard manure, artificial manures were applied as dressings; other plots were treated with artificial manures without farmyard manure.

In no single instance in all the trials recorded was there a case found in which farmyard manure failed to produce a considerable increase of crop. The amount of increase varied, the conditions under which the experiments were made being so diverse in regard to manures, soils, and climatic conditions.

Farmyard manure applied at the rate of 15 tons per acre gave the maximum yield. On the other hand, farmyard manure at the rate of 10 tons per acre proved insufficient of itself to produce a full crop, and the addition of artificial manures gave a very profitable increase.

Experiments in Yorkshire on the effects of liberal application of farmyard manure, as compared with an equally liberal and suitable combination of farmyard and artificial manures, gave results slightly in favour of the former, viz. :—

20 tons farmyard manure per acre, produced 10 tons 10 cwts.

10 tons farmyard manure,
1½ cwt. sulphate of ammonia,
6 cwts. superphosphate,
2 cwts. sulphate of potash,
} per acre, produced 10 tons 6 cwts.

For Potatoes it is not as a rule advisable to use artificial manures only, but under some conditions farmyard manure in moderate quantity, supplemented with suitable artificial manures, will give better results than farmyard manure alone. It has been proved that unless the artificials be composed of a suitable combination of ingredients, and be given in the right quantity, they will not produce a satisfactory crop. The combination that has given the best results when used alone is :—

6 cwts. superphosphate,
2 cwts. sulphate of ammonia,
1 cwt. nitrate of soda,
2 cwts. sulphate of potash (91 per cent),
} per acre.

From the above it will be seen that the selection of manures must depend on the nature of the soil, the climate, and the variety cultivated. In soils where the haulm grows too luxuriantly, no manure, or at all events none that would materially increase that luxuriance, should be applied, especially if the climate is moist. Superphosphate would probably be the best application under such circumstances. Varieties naturally dwarf will bear ammoniacal manures better than those that are naturally tall.

Propagation.—Potatoes are easily propagated by seeds, cuttings of the stem or branches, by planting whole tubers, or by those cut into sets. The seeds should be sown early in spring, in pans filled with rich light soil, placed in moderate heat. Before the young plants get crowded, they should be pricked out into small pots, and shifted as they require it; or they may be planted in rich soil under a frame with very slight heat, giving them plenty of air in fine weather, and more or less at all times when there is no danger of frost. The plants should be fully exposed before planting out, which had better be deferred till fine weather in May. They ought to be planted in a rich warm border, putting a

little leaf-mould below them, if it can be afforded, to assist their rooting. Afterwards they should be earthed up according to their strength. Only small tubers will be

Fig. 146.—Potato Tubers with new potatoes growing on them.

produced the first year (fig. 131); but these, planted in the following spring, will produce full-sized tubers. If neither glass nor artificial heat is at command, the seeds may be sown on a warm border.

Propagation by cuttings may be successfully resorted to for increasing any particular variety. For example, the original tuber may be cut into sets, planted early in spring, in heat, and the rooted shoots cut off near the base when they have reached a finger's length, and planted in rich soil. Fresh shoots will push again and again from the original sets, and may be treated in the same way. Propagation by planting the tuber, or parts of it furnished with eyes, is, however, the mode usually employed.

With many it is a doubtful question whether whole or cut tubers yield the greater return. From experiments made in the garden of the Horticultural Society at Chiswick it was found, on the mean of two plantations, one made in March and the other in April, that the produce from cut sets exceeded that from whole tubers by nearly 1 ton per acre. In the April planting the produce from the whole tubers was somewhat greater than that from single eyes; but in the March plantations the cut sets gave nearly 2 tons per acre more produce than the whole tubers, the weight of Potatoes planted being deducted in every case. In opposition to this must be placed the results of a similar experiment made at Wisley in 1917 which were that uncut sets gave a better yield than cut sets.

Another important consideration is, whether small or large tubers should be employed as sets; for, if by using the former an equally good crop could be obtained, a considerable saving in the expense of sets would be effected. Large tubers, however, are preferable for the following reason: In all plants large buds tend to produce large shoots, and small or weak buds the reverse. Now, the eyes of Potatoes are true buds, and in small tubers they are comparatively weak; they consequently produce weak shoots, and the crop from such is inferior to that obtained from plants originating from larger tubers, furnished with stronger eyes; and this conclusion has been arrived at as the result of actual experiments.

The part of the Potato employed for sets is not a matter of indifference. It has been found by experiment that sets formed of the rose end of the tubers, and planted in March, yielded at the rate of upwards of 3 tons per acre more produce than was obtained from employing the base of the tubers. In a plantation made in April the difference was much less, but still in favour of sets from the rose or top ends of the Potatoes. Cottagers may therefore use with advantage, say two-thirds of the base of the tuber, and put aside the top for sets.

In each and every case tubers for planting ought to be kept from exhausting themselves by premature sprouting. The loss of the primary sprout practically spoils Ashleaf as well as those with Lapstone blood in them, and greatly weakens the others. The former should therefore be stored in single layers, largest or sprout end upwards, in shallow trays (fig. 147), which may be stored one above another, always providing a certain amount of light and air reaches them. They even keep better left heavily moulded up where they were grown than they do in hampers, deep boxes, cellars, and warm rooms. All other varieties ought also to be stored thinly, and given all the light and air possible short of allowing them to be badly injured by frosts.

Potato Sets.—The eyes at the base of a Potato are few compared with those at the top, and they are also sometimes blind, or so weak that they do not push. Such sorts as Snowdrop, which have the eyes almost level with the general surface, are most apt to be blind. As the base of the eye slants downwards towards the centre of the tuber, the knife should be inserted above the eye, and the cut should slant downwards towards the centre, and parallel to the direction of the base of the eye. In times of scarcity, recourse has been had to merely scooping out the eyes for sets, or stamping them out with a hollow punch, the bulk of the Potato

in either case being left for food. By early planting in well-prepared soil, good plants can be reared by this mode, especially if the season prove favourable.

When only a small portion of the tuber accompanies the bud, the planting should be performed as early in spring as the state of the weather will permit. If the weather or state of the ground be unfavourable, the small pieces for sets may be placed with the buds upwards in soil under cover till they can be planted out in the open ground. Others cut the sets and dry them before planting, but this does not appear to be of any advantage; on the contrary, many of the dried sets do not push at all, and others but weakly.

A change of sets is advantageous. Instead of using tubers produced for many years successively in the same soil and in the same locality, it is found advantageous to obtain sets grown in a different soil, or in a different part of the country, or both. That it is profitable to procure sets from Scotland has been demonstrated again and again. This is not easily accounted for, but a possible explanation is that the Scotch grown sets are less mature than those grown further south.

Fig. 147.—Seed Potatoes in sprouting box.

Planting.—The usual time of planting is spring—from the middle of March—on warm borders, where they can be protected from frosts. Later plantings may be made, that for a main crop being not later than the end of April.

The distance apart at which the sets should be placed depends on the soil, the situation as regards exposure to light, and the sort planted. The rows ought to be 24 inches for early varieties and for later varieties 30 inches. This will allow sufficient room for earthing up, and also permits air and sunlight to reach the growing haulms. The stronger growers, being found the best disease resisters, are rightly more extensively planted in rich garden soils than formerly; they are also preferred for field culture.

The distance between the sets in the rows also should be regulated by the nature of the soil and the variety. In rich soil, of course, more space should be allowed than in poor; and considerably more for vigorous-growing sorts than for those with short stems.

The distance may vary from 12 to 15 inches. The less distance will be proper for the dwarf sorts, the greater for the strong-growing ones.

It is much better to have the rows 30 inches apart and the sets 12 inches asunder, than to have the rows 24 inches apart and the sets 9 inches from each other, as there is no advantage in overcrowding. Earthing up is easier, and less labour and sets are required in planting and the yield per plant is larger. The tubers also are more uniform in size.

A proper depth for the sets is 6 inches. This is shown by the following particulars of an experiment on the effects of different depths of planting: A piece of ground was divided into four equal parts, and planted with Potato sets in the second week in April, at the respective depths of 3, 4, 6, and 9 inches. The results computed for an acre are as follows:—

Depth. Ins.	Produce. Tons.	cwts.	lbs.
3	13	0	14
4	14	1	18
6	14	11	4
9	13	0	111

The greatest produce was from the plantation 6 inches deep; and next to it, from that at 4 inches. Those planted only 3 inches deep gave the least return. Many of the sets buried 9 inches did not vegetate, or at least failed to reach the surface.

Shallow planting is recommended for cold low-lying positions and heavy soils. In the latter case, laying the sets quite on the surface and heavily moulding over has been proved preferable to the practice of planting in drills.

Potatoes are planted in various ways ; but the modes usually adopted in gardens are in trenches cut out by the spade or digging-fork. The soil cannot be too loose, and trench-planting is the most satisfactory method. In planting in trenches, if the ground requires no manure, let an opening be taken out along one side of the quarter in the direction of north and south, or nearly so ; next, dig a breadth equal to rather more than half the distance between the rows, then stretch the line at the half-distance from the edge of the quarter, and cut down by the line to the depth of 6 inches, or to whatever other depth the sets are to be put. Then place the sets, with the eyes or buds upwards, in a line along the bottom, at the proper distance asunder, and cover them with some well-broken soil. After this dig another breadth, levelling the surface at the same time, and stretching the line at the distance which is to be allowed between the rows ; cut out another trench, plant the sets as before ; and so proceed till the whole is completed.

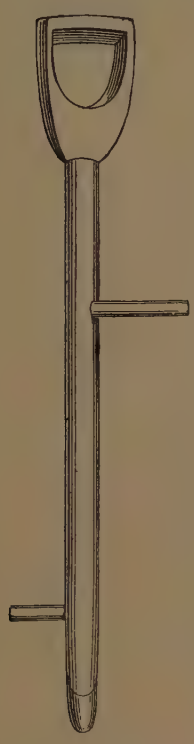

Fig. 148.—Potato Planter.

If dung is to be used, the trench must be made a little deeper. A wide opening should be maintained by drawing the soil well forward, so that the bottom of the trench may be wide and the layer of manure may be spread equally. It is advisable to throw some soil over the manure previous to placing the sets, which are liable to be injured if placed in contact with it.

Dibber-planting is perhaps the most expeditious. A dibber (see fig. 148) having a cross tread rather farther from the end than the depth at which the sets are intended to be planted, is used by one person to make holes, whilst another drops in the sets, so that the eyes of the latter may be uppermost. The holes are afterwards filled up with earth drawn by the hoe.

In dibber-planting, moist soils may be made too compact by the treading in performing the operation ; and, if the soil be dry and light, the earth falls more or less into the holes, and the sets are consequently not deep enough. For these reasons we consider that planting by the spade or fork—the latter answering best on badly working soils—is preferable to that by the dibber for garden crops ; and it will be found that the advantages with which the former method is attended will more than compensate for the saving of time effected by the latter.

In some parts of the country, and particularly in Lancashire, the ground for early crops is thrown up in ridges before winter ; in spring a portion of the pulverized soil from the surface of the ridges is collected in the bottom of the furrows ; a little manure is placed over this, and the sets are planted upon it and covered with 2 inches of soil. When the young plants appear another 2 inches of soil is added, and 2 inches more when they push through again.

Subsequent Culture.—This consists in stirring the surface of the ground, keeping it clear of weeds, and earthing up the plants. The more the ground is pulverized the better. It is a good plan to hoe it over, when not too moist, before the shoots reach the surface ; and again before earthing up, if it is not naturally friable. As regards the growth of the plant and bulk of produce, this operation is altogether unnecessary in deep, light soils ; for the roots are, in general, found below the level of the original surface of the ground, so that they do not derive any benefit from the operation ; and in dry seasons and in dry soils the crops from plants earthed up have been lighter than where they have not been earthed up, probably owing to the earth being drawn to a sharp ridge, by which the rain is thrown off beyond the roots.

Earthing up is advantageous, and even necessary, for Potatoes which have a tendency to throw their tubers above the surface. About ten days or a fortnight after the plants have appeared above-ground, a little earth should be drawn towards the stems, but not so as to cover the foliage, or interfere with its free exposure to light. If the soil is not very moist, and the season dry, this earthing up should be highest at the outsides, so that in consequence of the slope towards the plants the rain may penetrate to the roots ; and the earth should not be drawn so as to leave the interval deepest in the

middle, otherwise the rain-water would run there, instead of to the roots. On the other hand, where there is too much moisture, the earth should be made to slope from the plants. As these advance in growth the intervals between the rows should be stirred and made fine, to render the soil suitable for the second and final earthing up. The principal use of this is to form a covering for the tubers, so that with their increase in size they may not be exposed to light, which would soon render them unfit for human food, though good for sets. The soil should therefore be drawn, not so as to form a triangular ridge, with straight sloping sides, through which the tubers would be apt to protrude, but, on the contrary, broad-shouldered ridges, as wide at top as they can well be made. Their height will partly depend on the distance between the rows and partly on the depth of the roots. If the former is limited, no great amount of earth can be obtained; and such is also the case if the roots are near the surface.

Early Crops.—If Potatoes are wanted early, the tubers should be placed in a warm place, in January, till they push. They may then be planted where they can be protected with litter, fern, or other covering. Dwarf early sorts may be forwarded in pots in any warm place, and when above-ground they should be exposed to light and sun when there is no danger of frost. In March they may be planted out in front of a wall or paling, where they can be protected in case of severe weather. They may also be planted in some warm spot, in beds with dry turf sides, about 1 foot or 15 inches high, over which thatched hurdles can be placed at night, or as the state of the weather may render necessary.

Winter Crops.—Select a middling early sort, such as May Queen or Myatt's Ashleaf, and let the tubers be kept in a cool, dry place, on a hard bottom, and frequently turned, so as to check the vegetation as much as possible till the end of July. If then planted, tubers will be formed before winter, which should be taken up and packed in dry soil, closely beaten. Kept in this way they will form in winter a pretty good substitute for forced Potatoes.

The following is another method: Tubers of the preceding year's growth are kept in a cool place till autumn; care is taken to prevent vegetation as much as possible, and all sprouts are taken off as they appear. About three months before a supply is required, the old tubers are piled up in alternate layers with light garden soil, laid to the thickness of 5 or 6 inches, in a cellar or in boxes placed in any spot where there is a temperature of 50° or 60°. By this process, although no leaves are produced, small tubers are formed out of the substance of the larger ones; but, as might be expected, the produce is vastly inferior in quality to forced Potatoes.

Lifting and Storing.—Early crops, of course, are taken up as soon as they are fit for use. Before the disease attacked the Potato, the main crop for storing was allowed to remain till the stems and foliage withered from natural decay. After this had taken place, and before there was any danger from frost, was considered the best

Fig. 149.—Potato—Duke of York.

period for lifting. Such it still would be if there were no disease to arrest prematurely the vegetation of the plants, and render it necessary to remove earlier than usual the threatened crop of tubers. Waiting for the haulm to ripen or wither may mean the loss of a considerable portion of the crop from disease, whereas if lifting takes place directly the tubers are fully grown, and therefore, before the haulm has commenced to wither, the whole may be saved. This comparatively early lifting does not seriously affect the quality of the tubers nor their keeping properties. Dry weather is, of course, most favourable for the operation; but as for the necessity of drying Potatoes that are to be pitted in the soil, there is none; for we have seen Potatoes as wet as possible when pitted, that nevertheless came out dry enough. It is true the pits were not large, nor should they ever be; and their bases were higher than the level of any water which could collect around them, such being carried away by a track made for the purpose.

Non-exposure to Light.—If the weather is cloudy so much the better, for the tubers should be exposed to light as little as possible, and more especially not to bright sunshine. It is well known that all the green parts of the Potato are more or less poisonous, and so the finest white floury Potatoes become, by exposure to light. Potatoes may be white, black, or purple, externally, and their flesh, notwithstanding, be white and good when cooked; but expose them to the light for a longer or shorter period, according to its intensity, and the flesh of all will become green and unwholesome. Some persons dig up their Potatoes and leave them exposed to the sun's rays to dry previous to storing; but this is a bad practice, for three days of bright autumn sun will green newly-taken-up Potatoes to a very injurious extent; and this being the case, the tubers should not be exposed to the sunshine even for a single day.

It should therefore always be borne in mind that from the time Potatoes are taken out of the ground till they are to be cooked, they should be exposed to light as little as possible. If, after having been dug up, they must lie on the ground in heaps for but one day, or even less, they should be protected from light till they are pitted. If stored in a shed, loft, cellar, or any other place, light should be entirely excluded; if in a building, to the interior of which light must be admitted, it should nevertheless be prevented from reaching the tubers by some close covering. Tubers intended to be used as sets are supposed to be improved by partial greening.

Protection from Frost. — In choosing materials to protect the tubers from frost, and at the same time preserve them from being injured through heat or rot, care should be taken to avoid using anything that is likely to taint their flavour. Potatoes keep best in small quantities; for, when in large heaps, they sometimes ferment. The form of a ridge is more convenient than that of a cone, because when portions are taken out for use the breach in the end of the ridge can be more easily closed than one in the side of a conical heap. The ridges should run north and south, so that if it be necessary to open them in frosty weather, that may be done at the south end, when the sun's rays at noon will prevent that part from being frozen. The ridge may be about 3 feet, or not more than 4 feet wide at the base, and as high as the Potatoes can be conveniently piled up. It should not be formed on wet heavy ground; that which is poor, dry, and on a slope is to be preferred. In throwing up the soil for covering, a trench will be formed round the base of the ridge, and this trench should be made deepest at one end, from which a track should be cut, so that water may not collect in the trench, which ought in all cases to be lower than the base of the ridge. In dry soil the latter may be sunk a few inches, but if otherwise the Potatoes should be laid quite on the surface of the ground.

As already observed, soil is best next the tubers, and the poorer it is the better. Straw admits of the Potatoes being taken out comparatively free from earth; but as it decays from contact with the soil, it injuriously affects their flavour. Dry turf may be laid next the Potatoes to prevent loose soil from mixing with them, or fresh turf laid with its green side outwards may be used for the same purpose; but as regards flavour these appliances are unnecessary, if not worse.

After covering with 8 or 9 inches of soil, it is a good plan to thatch the ridges with straw, fern, heath, or any other material calculated to keep out frost and wet. Potatoes intended to be kept till the following summer should be placed in a shaded situation where the sun's rays cannot affect the ridges. If the soil of these should happen to be frozen in spring to the depth of a few inches, then by covering thickly with straw the Potatoes may be kept from pushing much longer than would otherwise be the case.

Forced Potatoes

Potatoes are forced in various ways—on hot-beds, in pits, and in pots placed in a vinery, Peach-house, or other structure where there is moderate heat with plenty of light.

Hot-beds.—The tubers which are to be planted should be placed close together on a gentle hot-bed, or on the floor of a cellar, to vegetate, and when they have made shoots 3 or 4 inches long they may be planted on the hot-bed and covered with 8 inches of good light soil. They may be planted 6 inches apart, in drills 5 inches deep, and 1 foot from each other, and covered with 2 inches of light soil; afterwards, when the stems grow strong, the drills can be filled up level with the rest of the surface. Water should be given sparingly, but as the plants increase in size it may be more liberally supplied. Air must be freely admitted whenever the weather is favourable; but at night, and in frosty weather, the sashes will require to be covered with straw mats or other protecting materials. A mild and nearly uniform temperature should be maintained. The tubers may be used when they are about 1 inch in diameter, the largest being taken first, and the small ones left to afford a supply in succession.

Fig. 150.—Potato—Up-to-Date.

London market-gardeners obtain early Potatoes by the following method: A long bed, 5 feet wide, is dug out to the depth of 2 feet. This is filled with hot dung, on which is placed a 6-inch layer of soil. Medium-sized whole Potatoes are used for planting; they are covered with 2 inches of soil, hooped, and covered over with mats and straw. In about a month they will have sprouted; frames are then got ready, placing 2 feet of hot manure along the whole line of framing, which is sometimes 100 yards in length; on this the soil is put to the depth of 8 inches; the Potatoes are carefully taken up from the striking-bed, all shoots are removed except the main one, and they are planted 4 inches deep. Radishes are then sown thinly over them. When the haulm of the Potato is 6 inches high the points are nipped off; this is done in order to give the Radishes a chance, and although it may stop the growth for a few days, still the crop of Potatoes is always excellent. Nothing more is required but to admit plenty of air, and give water.

Potatoes are also grown largely in hooped beds in the open ground. In the latter case the tubers are sprouted, as described. The beds or ridges are dug out 2 feet deep in January, filled with hot dung, and covered with soil to the depth of 10 inches. The Potatoes are taken up and planted 5 inches deep, and over them Radishes are sown. The ridges are then hooped over, allowing about 2 feet of space in the middle, between the mould and the hoop. They are covered with mats and straw; but as soon as the Radishes come up they are uncovered daily, and covered again every night. This is continued till the Potatoes are ready for digging in May, for sometimes large losses are occasioned by cold weather in April. Nothing more is done to the hooped beds beyond supplying them with water.

Pot Culture.—This is very simple; it is merely necessary to plant the sets in 8- or 11-inch pots, one set in the smaller and three in the larger size, filled to within 2

POTATOES

(From left to right): Arran Rose, Mauve Queen, Golden Wonder (behind), The Lochar

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or 3 inches of the top with light rich soil. The pots may then be placed near the glass in a vinery, Peach-house, or pit, where a temperature of from 50° to 60° is maintained. With the exception of watering, and putting more earth in the pots as the plants advance in growth, no further attention is required. It is advantageous to sprout the sets previous to planting, as already recommended.

Forcing may be commenced in December, and successional crops planted in January and February.

Insect Pests.—Potatoes are assailed by a host of insects, but in a healthy state wireworms are the most injurious. See chapter on this subject.

Diseases.—For diseases of the Potato see chapter on Plant Diseases.

The following report of experiments made at Wisley is taken with permission from the *Journal of the Royal Horticultural Society*, vol. xliii. (1918), p. 123.

The experiments dealt with :

I. The cutting of seed tubers.
II. The effect of various dressings on the cut surface of these tubers.
III. Greened and not-greened seed tubers, with different numbers of sprouts *v.* tubers taken straight from the clamp.
IV. Planting tubers of different sizes.
V. The effect of planting at different distances apart.
VI. The effect of date of planting.

In every case precautions were taken to obviate as far as possible errors due to differences in soil. This was usually done by repeating the treatment on two or three plots. Care was also taken that every group of plants had similar exposure to that with which it was to be compared, and in other ways to make the comparison between the plots as fair as it could possibly be.

I. *The Effect of cutting Seed Tubers.*

The variety used in this experiment was "Factor." The seed was grown at Wisley (third year) and was planted in mid-April, the rows being 27 inches apart, and the plants 18 inches apart in the rows. The plants were arranged in blocks of four rows of five plants, four blocks running across one of the garden plots. Twenty plants were grown under each treatment. The different treatments and the yields are shown in the table.

Taking the first eight groups first, it is evident that cutting the tubers tends to reduce the total crop, for No. 1 gave a greater yield than any of the others, while No. 2, where only the extreme heel end of the tuber was sliced away, was slightly less. There is a prevalent idea that unless the seed tuber "decays" the resulting crop is sure to be small, and this is generally true, but the cutting away of the basal part of the seed tuber is often stated to be an aid to the requisite "decay." Such cutting, however, has no influence in rendering the contents of the seed tuber available for the sprouts. In this series of experiments the tubers all decayed normally whether cut or not, but in another planting, of "Midlothian Early," where the crop was very poor, none of the tubers decayed whether cut or not.

It is clear also that the "rose end," where the greater number of eyes and usually the best developed eyes are situated, tends to give a higher yield than does the "heel end," *i.e.* the end of the tuber bearing the tag which attached it to the old plant. This point is confirmed by comparing Nos. 9 and 10 with Nos. 11 and 12, where the same tendency is apparent. The "rose end" seems, too, to possess some advantage over the half tuber cut lengthwise, *i.e.* where "rose end" and "heel end" are both represented, for the yield of No. 7 is higher than either No. 5 or No. 6. The lower yield of Nos. 5 and 6 may be due to the increased amount of unprotected surface exposed, for the size of the surface exposed seems to have had some effect upon the yield when a long time elapsed between cutting and planting. The tubers cut lengthwise in January gave a smaller yield than those cut in the same way immediately before planting; the difference was much less when the tubers were cut crosswise and similarly treated; and merely cutting away the extreme heel end reduced the yield but little. In this series liming the cut surface, whether the cut was made at planting time or in January, seems to have reduced the yield to some extent, unless the failure of two sets in the unlimed January cut series (No. 5) is to be attributed to the cutting.

Nos. 9 to 12 were larger tubers than those used in groups Nos. 7 and 8, and gave larger yields under similar treatment. This result should be compared with those in Series IV.

Sets.				No. of Plants Surviving.	Yield.							
Size.	Cut.	Time of Cutting.	Limed or Not.		Ware.		Chats.		Total.		Average.	
					lb.	oz.	lb.	oz.	lb.	oz.	lb.	oz.
1. Seed	Not cut	...	...	20	50	10	2	6	53	0	2	10½
2. ,,	Sliced at bottom	Planting time	Not	20	49	4	1	10	50	14	2	8¾
3. ,,	Lengthwise	,,	,,	20	48	6	1	5	49	11	2	7½
4. ,,	,,	,,	Limed	20	45	4	0	11	45	15	2	4¾
5. ,,	,,	January	Not	18	34	4	1	0	35	4	2	0
6. ,,	,,	,,	Limed	20	34	6	0	12	35	2	1	12
7. ,,	Rose end	,,	,,	20	44	2	1	11	45	13	2	4¾
8. ,,	Heel end	,,	,,	20	37	15	0	14	38	13	1	15
9. Ware	Rose end	Planting time	,,	20	49	5	1	11	51	0	2	9
10. ,,	,,	January	,,	20	49	6	1	2	50	8	2	8½
11. ,,	Heel end	Planting time	,,	20	42	9	1	6	43	15	2	3
12. ,,	,,	January	,,	20	41	10	1	0	42	10	2	2

It may be pointed out that, where seed is scarce or expensive, cutting the sets, in spite of the reduction in yield from each plant, gives a much greater return from a given weight of seed. Thus the twenty uncut tubers gave a crop of 53 lb.; but twenty seed tubers of the same size cut in half lengthwise at planting time to make forty plants gave 95 lb. 10 oz.; twenty of the same size cut in half lengthwise in January, of which thirty-eight halves survived, gave 71 lb.; twenty of the same size cut in half transversely to make forty plants gave 84 lb. 10 oz.

II. *The Effect of Various Coverings on Cut Surfaces of Potato Tubers.*

In order to test the effect of various substances which might be used for covering the surface of tubers cut for propagation purposes in order to prevent loss of moisture, etc., a number of tubers of seed size (variety, " Factor ") were cut lengthwise in January and dusted with the substances mentioned in the following table The cut tubers were planted in mid-April after sprouting, in rows 27 inches apart and 18 inches apart in the rows, and the different groups of twenty cut pieces arranged as in Series I.

Covering.	No. of Plants surviving out of 20.	Weight of Crop.
1. No covering	20	28 lb. 10 oz.
2. Keen's Cement ..	19	33 lb. 15 oz.
3. Painter's Knotting	16	21 lb. 6 oz.
4. Size	20	32 lb. 13 oz.
5. Loam	19	24 lb. 11 oz.
6. Sand	16	26 lb. 8 oz.
7. Plaster of Paris...	19	38 lb. 8 oz.
8. Flowers of Sulphur	20	32 lb. 4 oz.

It seems evident that plaster of Paris is one of the best materials for checking loss of moisture where tubers are cut before planting, while Keen's Cement, Size, and Flowers of Sulphur follow. As might be expected, loam and sand are of little use, but Painter's Knotting, strangely enough, seems actually detrimental, for, while four of the twenty halves died, the surviving sixteen gave a smaller average crop than any of the others.

III. *Effect of Greening and Number of Sprouts on Seed Potatoes on Yield.*

The importance of sprouting potatoes before planting them is now almost universally recognized, although there still prevails an erroneous idea that sprouting is necessary only in the case of early varieties. The increase in yield of all varieties through sprouting has been found to average two tons to the acre, and it is therefore manifest that sprouting before planting ought not on any account to be neglected. In this experiment the results of sprouting in full light show only a negligible advantage over those obtained by sprouting in the dark; but it is to be observed that the short, sturdy sprouts formed on tubers sprouted in the light are less liable to damage during planting than are the more slender delicate shoots produced when tubers are sprouted in the dark.

At the same time the yield of tubers sprouted in trays, whether in the light or in darkness, is in remarkable contrast with that of tubers of the same stock kept in the clamp and urged to the production of spindly sprouts exhausting the tuber by the conditions there.

Group.	Treatment.	No. of Sprouts left when Planting.	Yield.		
			Ware and Seed.	Chats.	Total.
			lb. oz.	lb. oz.	lb. oz.
1	Greened and sprouted	1	41 13	0 12	42 9
2	" "	2	49 2	0 14	50 0
3	" "	none	31 6	1 14	33 4
4	" "	all	48 9	1 14	50 7
5	Sprouted in dark	1	44 1	0 11	44 12
6	" "	2	49 4	1 0	50 4
7	" "	none	37 7	1 4	38 11
8	" "	all	41 15	0 11	42 10
9	Exhausted and shrivelled in clamp	1	37 13	1 1	38 14
10	" "	2	41 6	1 0	42 6
11	" "	none	23 3	2 3	25 6
12	" "	all	34 2	2 14	37 0

The variety used was " Factor," as in Series I. and II.; the tubers were of seed size, and they were planted as described in the first two series. Twenty plants were grown in each group. The superiority of the seed sprouted in trays over that allowed to sprout and exhaust itself in the clamp is plain from the foregoing table, for the average yield of the tray-sprouted seed was 2 lb. 2½ oz. of useful produce, while that from the clamp-exhausted tubers was only 1 lb. 10 oz., an advantage of over ½ lb. a plant in favour of tray-sprouting.

It is also evident that in all cases it was better to leave one sprout than to rub all off at planting time, and better still to leave two sprouts than one. To leave two sprouts seems also better than to leave all produced; the advantage is shown both in total yield and in the weight of chats produced, for usually more chats were produced where all sprouts were left than where all were removed but one or two.

The reduction in crop where all the sprouts are removed is doubtless due in part to partial exhaustion of food material, and in part to delay in starting growth and the consequent shorter growing period. The latter point is well illustrated in Series VI. of these experiments.

IV. *Effect of Size of Seed on Tuber Yield.*

Another series of experiments throws some light on the reason of the low yields from exhausted tubers seen in Series III. The small tubers of one ounce gave a markedly smaller yield than those of two ounces or over. " Factor " was used in this series, the seed tubers being taken from the same stock as those used in the first three series of experiments. The distance apart was the same as in the foregoing, and twenty tubers were planted in a row. There were three groups; in one the seed tubers weighed approximately one ounce each, in the second two ounces, and in the third three ounces, and each group was repeated four times, so that eighty seed tubers of each kind were planted. The planting was done in mid-April, and the plants were lifted and weighed on September 3 after they had died down.

Size of Tuber.	Yield.		
	Ware and Seed.	Chats.	Total.
	lb. oz.	lb. oz.	lb. oz.
1. Small, about 1 oz. .	145 14	5 1	150 15
2. Medium, about 2 oz.	175 10	5 0	180 10
3. Larger, about 3 oz.	183 8	5 6	188 14

The yield of the medium and larger tubers, of about the size usually regarded as "seed size," was markedly greater than that of the small tubers, and the chats were somewhat less in proportion to the yield. A striking thing, however, which is not brought out in the table, but which is evident on comparison of the weights of the individual plant-yields, is the tendency of the small tubers to produce a great proportion of plants giving only a small yield, and a small proportion only giving a larger yield than the average. The contrast in this direction with the yield of those of a larger size is very marked.

V. *Effect of Spacing on Yield.*

An endeavour was made to ascertain the effect of the amount of space available for the development of the individual plant upon the yield both of the individual and of equal plots of land occupied by the differently spaced plants. The variety "Arran Chief" was used in this experiment, the seed having been grown at Wisley in 1916. As usual, the seed was sprouted before planting. The crop was lifted after the plants died down in September 1917. The results are shown in the above table, where each space represents an area of one square rod; the top line in each space shows the distance apart of the rows and the plants in the rows on the plot in inches, and the area occupied by each plant in square feet; the first row of figures shows the yield of ware and seed, the second the weight of chats, and the third the total yield from a plot of one square rod, and the last line shows the average weight of produce from each root. The exposure of all the plants on each plot was the same; failures in the rows have been allowed for in arriving at the totals and averages, and the totals given are averages of duplicate series.

1			2			3		
24″ × 12″ = 2 sq. ft.	lb.	oz.	24″ × 15″ = 2½ sq. ft.	lb.	oz.	24″ × 18″ = 3 sq. ft.	lb.	oz.
Ware and seed ..	227	12	Ware and seed ..	199	1	Ware and seed ..	184	8
Chats	28	9	Chats	22	11	Chats	15	11
Total	256	5	Total	221	12	Total	200	3
Average plant ...	1	14½	Average plant ...	2	1	Average plant ...	2	7
4			**5**			**6**		
30″ × 12″ = 2½ sq. ft.	lb.	oz.	30″ × 15″ = 3⅛ sq. ft.	lb.	oz.	30″ × 18″ = 3¾ sq. ft.	lb.	oz.
Ware and seed ..	187	11	Ware and seed ..	198	1	Ware and seed ..	202	6
Chats	23	0	Chats	21	13	Chats	17	0
Total ...	210	11	Total	219	14	Total	219	6
Average plant ...	2	0	Average plant ...	2	9	Average plant ...	3	4
7			**8**			**9**		
36″ × 12″ = 3 sq. ft.	lb.	oz.	36″ × 15″ = 3¾ sq. ft.	lb.	oz.	36″ × 18″ = 4½ sq. ft.	lb.	oz.
Ware and seed ..	181	13	Ware and seed ..	172	2	Ware and seed ..	164	0
Chats	20	5	Chats	12	3	Chats	15	11
Total	202	2	Total	184	5	Total	179	11
Average plant ...	2	4	Average plant ...	2	10	Average plant ...	3	4

It will be seen that, within the limits of spacing used in this series of experiments, two points stand out quite clearly:

1. The greater the space given to the individual plant the greater the yield of that individual is likely to be.

2. The greater the number of plants on a given area the greater the yield from that area will be.

It follows that in order to produce the greatest yield from a given area, planting of potatoes must be somewhat close rather than wide (*i.e.* within the limits shown by this experiment); but if it is desired to raise a large quantity from a small number of seed tubers, the tubers must be planted far apart.

VI. *Effect of Time of Planting on Yield.*

Sprouted seed tubers of approximately equal size of the same stock of the variety "Windsor Castle," grown at Wisley in 1916, were planted on five different dates, viz. April 4, April 16, May 1, May 15, June 1 respectively. They were planted in rows 2 feet 6 inches apart and 18 inches apart in the rows, and were grouped in sets of sixty plants, twenty in a row, each group being duplicated, so that 120 tubers were planted on each date. The yields were as follows. The plants were lifted as they died down:—

Planted.	Lifted.	Yield.		
		Ware and Seed.	Chats.	Total.
		lb. oz.	lb. oz.	lb. oz.
1. April 4	August 31	262 12	9 11	272 7
2. „ 16	„ 31	274 5	9 3	283 8
3. May 1	September 3	274 1	11 15	286 0
4. „ 15	„ 20	229 5	11 13	241 2
5. June 1	„ 20	172 2	14 0	186 2

There is little difference in the yields of the first three plantings, no doubt because the weather up to the middle of April did not encourage growth, while after that the plants made steady progress without the usual set-backs due to late frosts and the like; but the late plantings, especially the June one, led to serious reductions in

the crop, moreover the proportion of chats was markedly greater in both late plantings, but especially in the June-planted set. April seems the best month to plant at Wisley, and though seasons may make some difference, for all but quite early varieties planted in the most favourable positions, probably from the middle to the end of the month is best if the seed is previously sprouted.

Varieties of Potatoes

Early Kidney.

Duke of York (fig. 149).—Haulm somewhat strong; no flowers; tubers large, of good form, white in colour, flesh slightly yellow. Cooks well, and the flavour is good.

Fig. 151.—Potato—Sharpe's Express.

Early Eclipse.—Haulm strong and branching; tubers large, smooth, white, flesh yellowish. Quality good.

Early Favourite.—A smooth-skinned Potato with medium haulm, splendid variety for light and medium soils.

Early Puritan.—Haulm moderately strong; flowers white; tubers large, inclined to be oval, skin and flesh white, usually floury when cooked.

May Queen (Sutton).—Haulm moderately strong; tubers large, of good form, floury-white and of good flavour when cooked. An extra early sort, excellent for forcing.

Myatt's Ashleaf.—Haulm moderately strong; flowers coloured; tubers white, flesh yellow. A heavy-cropping and very old favourite.

Ninety-fold (Sutton).—Haulm erect and dwarf; flowers white; tubers large, perfect in form, skin white, flesh very white and of good flavour. An extra heavy cropper. A valuable addition to early varieties.

Sir John Llewelyn.—A first-class early variety, heavy cropper and good cooker, tubers of a useful size.

Ringleader (Sutton).—Haulm moderate in height and robust, foliage quite unlike that of the Ashleaf class. One of the earliest Kidney Potatoes, and has the advantage of being white in flesh. Immediately the tubers are large enough to lift, the flavour and quality are excellent.

Royal Ashleaf (Rivers).—Haulm moderately strong; flowers coloured; tubers long and thin, skin white, flesh yellow, of good flavour when cooked. A moderate cropper.

Resistant Snowdrop.—Haulm strong and branching; tubers medium to large, variable in shape, rough, russeted; eyes shallow; mealy and white when cooked.

Sharpe's Express (fig. 151).—Haulm medium; flowers purple; tubers medium, smooth, white fleshed; an excellent cropper; does well on light soil. A first-rate early.

Victor (Sharpe).—Haulm short; flowers coloured; tubers oval in form, moderately large, skin white, flesh yellow and of good flavour when cooked. Suitable for forcing.

Early Round.

A1 (Sutton).—Haulm short and strong; tubers round, skin white, yellow, rather firm when cooked. Heavy-cropping and good for forcing.

Edzell Blue.—Haulm over 3 feet; flowers white; tubers medium to large, usually rough, red purple; eyes deep; flesh white, fairly mealy. A great cropper.

Harbinger (Sutton).—Haulm dwarf and strong; no flowers; tubers medium, skin white, flesh very white and of good quality when cooked. Popular for pot and frame culture.

Royalty (Carter).—Haulm moderately strong; flowers white; tubers oval-shaped, white, flesh very white when cooked and of good flavour. One of the heaviest croppers in the section.

Ruby Queen.—Haulm low and strong; flowers coloured; tubers moderately large and of good form, skin purple, flesh white. A good cropper.

Second-early Kidney.

British Queen.—Haulm tall, strong, and branching; flowers white, tubers large, oval in form, skin white, flesh very white, of excellent quality when cooked. A heavy-cropping variety.

Centenary (Sutton).—Haulm sturdy and strong; tubers moderately large, perfect in form, skin white, flesh white and floury. A heavy-cropping, disease-resisting variety; one of the best for field culture.

Challenge (Findlay).—Haulm extra strong; flowers coloured; tubers large, oval, skin white, flesh very white and floury when cooked. A heavy-cropping, disease-resisting variety.

Favourite (Cole).—Haulm moderately strong; flowers white; tubers large, oval, and of good form, skin white, flesh cooking very white. A good cropper.

Ideal (Sutton).—Haulm strong and branching; tubers large, oval, and pleasing in appearance. Of excellent quality when cooked. A heavy-cropping, disease-resisting variety, good alike for garden and field culture.

Jeannie Deans.—Haulm tall; flowers coloured; tubers large, oval, skin and flesh white. A good reliable variety.

King George.—Haulm 2½ feet; leaves large, dull green; flowers white; tubers medium, brown-yellow, netted; flesh white, mealy when cooked. A very free cropper, little subject to disease.

Majestic (fig. 152).—Haulm sturdy, of medium height; tubers white, large, with shallow eyes. A great cropper; when cooked white, floury, and of excellent flavour. Recommended as a disease resister.

Supreme (Sutton).—Haulm moderately strong; tubers large, pebble shape, and perfect in form, skin sometimes russeted, flesh white, cooking dry and floury. A heavy-cropping sort.

Second-early Round.

CONQUEST (Findlay).—Haulm 2 feet, branching; flowers white; tubers medium, flattish-round, skin rough, yellowish, flesh pale yellow, mealy and yellow when cooked. Very heavy-cropping, tubers rarely diseased.

GREAT SCOT (fig. 153).—Haulm 2½ feet; leaves medium, glossy; flowers white; tubers round, medium, regular; skin rough, yellow-white; flesh pale yellow and mealy when cooked. A very popular potato, as it does well in most soils and situations.

MONARCH (Carter).—Haulm stout and branching; flowers white; tubers large, varying in

Fig. 152.—Potato—Majestic.

DOBBIE'S FAVOURITE.—Immense cropper and disease resister; tubers medium in size, good shape, keeps well, and cooks beautifully.

form from round to oval, skin white and rough, flesh slightly yellow and of excellent quality when cooked. A good cropper.

Fig. 153.—Potato—Great Scot.

EPICURE.—Haulm tall and strong; tubers large, flat-round, skin white, flesh very white, floury and good in flavour when cooked. A heavy cropper.

READING RUSSET.—Haulm strong and branching; flowers white; tubers moderately large and perfect in form, skin red and russety, flesh very white. A popular, fairly heavy-cropping variety.

THE DUCHESS.—Haulm 2 feet, spreading; flowers white; tubers flat-round, medium; skin rough, yellow tinged with pink; flesh pale yellow, firm, mealy when cooked. A first-rate sort.

WINDSOR CASTLE (Sutton).—Haulm tall and strong; flowers white; tubers large, perfect in form, skin and flesh white. In every respect a good variety.

Late Kidney.

CHARLES FIDLER.—Haulm tall and strong; flowers white; tubers large and long, skin white, flesh white and floury when cooked. A heavy cropper; succeeds well under field culture.

COUNTY COUNCILLOR.—Haulm tall and strong; flowers coloured; tubers large and oval in form, skin and flesh white, cooking well. A heavy cropper, and resists disease well.

GRAND MONARCH (Dickson).—Haulm tall, strong, and branching; flowers coloured; tubers fairly large, oval, with white skin, white and floury when cooked. One of the heaviest croppers, not much addicted to disease.

GOLDEN WONDER.—Haulm 4 feet; leaves large, glossy; flowers mauve; tubers medium, skin rough, netted, brown with yellow patches; flesh lemon yellow, mealy when cooked. A favourite.

GOLDFINDER (Webb).—Haulm tall and stout; flowers coloured; tubers oval in form, skin and flesh white, and excellent in quality when cooked. A heavy-cropping variety.

KING EDWARD VII.—Haulm 3 feet; flowers white; tubers large, flat-round, pale yellow, with red eyebrows. Cooks white and mealy. A first-rate main crop variety; a heavy cropper; excellent for table or exhibition.

LANGWORTHY.—Haulm 4 feet; leaves large, glossy; flowers mauve; tubers medium to large, yellow-white, flesh yellowish when cooked. One of the best varieties, requires well-cultivated land to get good results.

RELIANCE (Sutton).—Haulm tall and strong; flowers white; tubers large, good form and quality, skin and flesh white. A great cropper.

THE ADMIRAL.—Haulm 4 feet; flowers white; tubers large, skin and flesh whitish, mealy when cooked. A heavy cropper, free from disease.

THE BRUCE.—Haulm strong and erect; flowers coloured; tubers moderately large, skin white, flesh yellowish-white. Not a heavy cropper, but resists disease well.

THE LOCHAR.—Haulm 3 feet; leaves large; flowers white; tubers flat-round, rather squarish; medium, skin smooth with pink flesh and spots; flesh pale yellow, white, and rather firm when cooked. Proved the heaviest cropper in a trial at Wisley, and is said to be disease-proof.

Late Round.

ABUNDANCE (Sutton).—Haulm tall and strong;

Fig. 154.—Potato—The Factor.

tubers moderately large, skin and flesh white, cooking admirably. Heavy-cropping and reliable.

KERR'S PINK.—Haulm 3 feet; leaves medium, wrinkled; flowers white; tubers flat-round or round, large, skin smooth, pink, darker round eyes, which are deep; white and mealy when cooked. A first-rate main crop potato.

SYON HOUSE (Veitch).—Haulm tall and strong; tubers oval in form, large, skin white and rough, and a good cooker. Moderately heavy-cropping and generally reliable.

THE FACTOR (fig. 154).—Characters as in Up-to-Date. A reliable cropper; good keeper; excellent when cooked.

UP-TO-DATE.—Haulm tall, strong, and branching; flowers coloured; tubers large, oval in form, with white, rough skin, flesh also white. A deservedly popular variety with all classes of growers.

PURSLANE (*Portulaca oleracea*).—An annual, native of India, but naturalized in other countries, including England. It has succulent stems and leaves and small yellow flowers. The leaves are eaten cooked, or as a salad; they are also pickled.

Purslane requires a light rich soil and a sunny situation. It should be sown in May out-of-doors, in shallow drills 9 inches apart, or thinly broadcast, and very lightly covered with earth. For an early supply it is sown under glass, on a gentle hot-bed from December to March. It may be sown for succession from May to August.

Seeds should be saved from the most vigorous plants of the first sowing; and as soon as the capsules begin to open, the plants should be carefully cut over and spread upon a cloth in the sun; the seeds can afterwards be separated from the seed-vessels by rubbing with the hands and sifting.

There are three varieties, viz. *Green*, which is a robust form of the wild type; *Golden*, with leaves of a yellowish colour; and *Large-leaved*, distinguished by the large size of its leaves and its dense habit.

QUINOA (*Chenopodium Quinoa*) (fig. 155).—An annual, native of Peru. It has stems 4 to 6 feet high, and arrow-shaped mealy leaves. In the high table-lands of

Fig. 155.—Quinoa (*Chenopodium Quinoa*).

the Cordilleras, at the time of the conquest by the Spaniards, it was almost the only farinaceous seed used as food; and it still forms, together with the Potato, the common food of the poorer inhabitants of those regions. The seeds are used in soups or made into a sort of bread, and are said to be easy of digestion, and in no way prejudicial to the health. By fermenting them together with Millet, a kind of beer is made. The young leaves form a good substitute for Spinach in summer. They are produced in great abundance, and are said to be good food for cows.

The Quinoa requires a light rich soil and a warm situation. Its seeds may either be sown on a gentle hot-bed in March, for planting out in April or May; or out-of-doors in April, in drills 2 feet asunder. When the plants are 4 or 5 inches high they may be thinned out to 18 inches apart in the rows, and the thinnings may be planted in rows at the same distances apart; by this mode the plants may be easily propagated. In dry weather water should be given; and if the plants are grown for Spinach, the stems should be topped at the first gathering, to induce them to branch. The leaves may be gathered in succession throughout the summer. The seeds ripen in September.

RADISH (*Raphanus sativus*).—An annual, widely cultivated. "There is no doubt that the species is indigenous in the temperate regions of the old world; but as it has been cultivated in gardens from the earliest historic times, from China and Japan to Europe, and as it sows itself frequently round cultivated plots, it is difficult to fix upon its starting-point" (De Candolle). It is chiefly cultivated for the roots; but the seed-pods, pulled when green, are occasionally pickled, and the seed-leaves are sometimes used as a salad.

The Radish will succeed well in any garden soil that is not over moist or too heavy. For early and late crops a warm sheltered situation should be chosen; whilst for those sown in the heat of summer a rather shady spot is preferable. The ground where the sowing is to be made should be deeply dug, and raked fine. The seed is generally sown thinly broadcast, in beds from 4 to 5 feet wide, with 1-foot alleys between, the soil from the latter being used to cover the seeds, but only lightly. The surface is then raked smooth, and in light soils pressed with the back of the spade. Winter Radishes, however, are best sown in drills 6 inches asunder; but if roots of large size are desired, as much as 9 inches may be allowed. After sowing, the beds should be protected from birds, which are very fond of the seeds.

Where Radishes are not forced, a sowing may be made in the middle of December, if the weather is mild; and immediately after having been sown the seed-beds should be covered with about 4 inches thick of litter, which should not be removed till the plants come up and then only in the day-

time when the temperature is above 32°. The crop, if not destroyed by frost, will be fit for use about the beginning of March; but this greatly depends upon the weather.

A sowing, to be treated in a similar manner, may be made in the course of January, weather permitting, and another in February. With the Parisian market-gardeners this is the first crop of Radishes raised out-of-doors. For this sowing they form a bed by digging a trench 18 or 20 inches deep, and filling it up with from 14 to 18 inches of dung, which is covered with 4 inches of vegetable mould. On this the seed is sown; and if the weather is frosty at night the bed is protected with straw mats. Another sowing, also in a warm situation, may be made in the second fortnight of February, and from that time till the middle of October a small quantity may be sown, in any open situation, every fortnight in spring, and every ten days in the heat of summer.

Lastly, in the end of October, and again in the middle of November, a small sowing may be made on a south border or on a sloping bank. The plants from these sowings must be protected in severe weather

Fig. 156.—Radish—French Breakfast.

with litter, or straw mats, which should be removed in favourable weather. After sowing, with the exception of thinning out the plants, where too close, to about 3 inches apart, weeding, and frequent watering, no further attention is necessary.

Fig. 157.—Japanese Radish.

Winter Radishes may be sown in the beginning of July, and again in August, in shallow drills from 6 to 9 inches asunder, and the plants where too close may be thinned out or drawn for use in a young state, so as to leave those which are intended to attain a large size at 5 or 6 inches from each other in the row. The roots are fit for use towards the end of autumn. Those required for winter consumption should be taken up in November or December, before severe frost sets in, and stored in dry sand, like Carrots.

Forcing.—The best sorts for forcing are the Oblong Olive, Early Frame, and the Red and White Turnip sorts. The seeds should be sown in light rich soil, laid to the thickness of 8 or 9 inches on a moderate hot-bed, or in a pit where a temperature of from 55° to 65° is maintained. About an ounce of seeds will be sufficient to sow 25 square feet. If the plants come up too thickly they may be thinned to about an

inch apart; afterwards, thinning will be effected sufficiently well by drawing the most forward for use. Gentle waterings should occasionally be given, and air admitted at every favourable opportunity; but the sashes must be covered at night and in frosty weather with straw mats or other protecting materials. A sowing may be made every fortnight from the beginning of November till the middle or end of February, and the crop will generally be fit for use about six weeks after sowing. Radishes are frequently forced along with Carrots, or between the rows of Endive and Lettuce.

To save Seeds.—Only the finest plants, true to name, should be selected from one of the spring sowings for producing seeds. They should be taken up in April or May, and planted 2 feet apart in well-dug ground, water being given at planting, and subsequently till they take fresh root. The seeds ripen in September, and must be gathered successively as they come to maturity. They should then be dried in the sun, rubbed out of the pods, and stored. They retain vitality for four or five years. Seeds of winter Radishes are saved from full-grown roots, transplanted in March.

CHINESE ROSE.—Root somewhat conical, of a bright-rose colour; flesh solid, of fine texture, rather hot.

CHINESE WHITE.—Root turbinate, white; flesh tender, excellent, and mild in flavour. The leaves are long, nearly entire, and very unlike those of the other varieties.

EARLY FORCING (Turnip-rooted forms).—Excellent short-topped varieties of very quick growth, coming into use before any other sort; fine for forcing.

Fig. 158.—Radish—Long Scarlet.

EARLY FRAME.—Root long, of better shape than the old variety. One of the forwardest of the long Radishes; very crisp and sweet; colour rich-crimson. Quite distinct from Wood's Frame.

EARLY GEM.—An improved early scarlet, white-tipped, Olive-shaped variety, with an exceedingly small top; well adapted for frame use, as, owing to the almost absence of leaf, many roots may be grown in a limited space.

EARLY OLIVE-SHAPED (Scarlet and White).—These two have proved to be among the earliest varieties, and are fit for use five weeks from date of sowing.

Fig. 159.—Radish—Scarlet Turnip.

EARLY ROSE GLOBE.—A very early and much-esteemed sort; root slightly ovate, and of a fine clear rosy-scarlet colour.

FRENCH BREAKFAST (fig. 156).—Root oval-shaped, bright-crimson with a white tip; flesh white, solid, and sweet; leaves small. A good forcer.

JAPANESE RADISH (fig. 157).—A long white variety, which grows to a very large size, often 16 to 20 inches long and 3 inches in diameter. The seeds should be sown in April, on deep, well manured soil. It is known in Japan as *Ninengo daikon*.

LONG SCARLET (fig. 158).—Root long, rose-red; flesh white, transparent, crisp, and of good flavour. Much cultivated for the London market. There are several forms of it, such as Scarlet Short-top, Early Frame, and Wood's Early Frame. The best for forcing.

LONG ROSE.—Similar in shape to Long Scarlet, but comes rather larger, and of a beautiful rose tint.

LONG WHITE.—A very handsome white Radish, crisp and tender; appreciated both for its shape and excellent quality.

SCARLET GLOBE.—Colour brilliant-red; flesh white, mild, and of excellent flavour; remains crisp when other sorts are past. May be had all through the winter.

SCARLET OLIVE.—Root oval, bright-crimson; flesh rose-coloured, tender, and excellent. It is early, well adapted for forcing, and for the general crops. French Breakfast differs in having the lower part of the root white. WHITE OLIVE is of the same shape and qualities, but the root is shorter and white.

SCARLET TURNIP (fig. 159).—Root deep-scarlet; flesh white, sometimes stained with red, of mild flavour. Much cultivated for the London market. Early Scarlet Turnip, the flesh of which is rose-coloured, appears to be a sub-variety. PURPLE TURNIP differs only in colour.

SPANISH BLACK.—Root of large size, oval, with a long slender tap-root, outside rough and black; flesh white, hard, and hot. The Purple Spanish

or Large Purple is a sub-variety. Sow in the autumn for use in winter.

Spanish White.—Root oval, large, white, tinged with green; flesh white, solid, and hot.

Sutton's Gem.—Root ovate; suitable for forcing, matures quickly and develops but little leaf; colour rose, tipped with white; flavour excellent.

The Sutton.—In form and colour this long-rooted Radish is distinct from all others. Flesh snowy-white, tender, and delicious in flavour, and the roots remain crisp for a long time.

White Turnip.—Root round, terminating in a small fibrous root, outside white; flesh white, transparent, and of mild flavour. Early White Turnip resembles the preceding, but is smaller. An early and excellent variety, very generally cultivated.

RAMPION (*Campanula Rapunculus*) (fig. 160).—A biennial, native of Europe, including Britain. It is cultivated for its fusiform, white, and fleshy root, which is generally eaten raw, but sometimes in a boiled state in salads; the leaves as well as the roots are occasionally used in winter salads.

Fig. 160.—Rampion (*Campanula Rapunculus*).

It prefers a rich, light soil and a shady situation. It is raised from seeds, sown any time between March and July; but if sown earlier than the end of May the plants are apt to run to flower the same year, and when this is the case the roots become tough and unfit for use. The ground should be well dug, and raked as fine as possible; the seed may then be sown either broadcast, or in drills 6 inches apart and about ¼ inch deep, formed by pressing the angle of a measuring-rod upon the ground. As the seeds are very small it is advisable to mix them with fifteen or twenty times their bulk of fine sand, in order to ensure their even distribution in the drills, and to prevent the plants from coming up too closely. The seeds should be slightly covered, and be frequently watered till the plants come up, which will be in about a fortnight. When they are an inch high they should be thinned out to about 4 inches apart; after this no further care is necessary than to water frequently, and to keep the ground free of weeds. Small sowings may be made in the end of June and July, in case the plants from the May sowing should run.

The roots will be fit for use from November till April or May, and they may either be pulled up as wanted or taken up in bulk and stored in sand. The plants send up flower-stalks about 2 feet high, which bear small blue or white flowers in July and August. The seeds ripen in autumn.

RHUBARB (*Rheum*).—The genus Rheum consists of about twenty species of stout, large-leaved herbs with large woody roots. They are all natives of Central Asia and the Himalaya. The varieties of Rhubarb grown for culinary purposes in Great Britain and North America are said to have sprung from *R. Rhaponticum* and *R. undulatum*, both natives of Siberia and grown in this country since 1573. The use of the leaf-stalks for making tarts, &c., is of comparatively recent date, and is as yet scarcely practised on the Continent. They are much appreciated by Britishers, however, both on account of their flavour, and also as wholesome food. They form an excellent substitute for fruit in tarts and pies. They also make a delicious preserve, and a wine is obtained from them.

Rhubarb succeeds best in a rich deep soil, rather light than otherwise, and well exposed to light. It may be raised from seeds sown in spring, but the mode of propagation generally adopted is by dividing the roots, a bud, of which there are several on the crown, being preserved to each piece.

The ground having been deeply trenched, and well manured with rotten dung, the divisions of the roots may be planted with the bud about 2 inches below the surface, 3 feet apart, in rows from 3 to 4 feet asunder,

according to the variety planted and the quantity of ground at disposal. The plantation should be made as early in spring as the weather and state of the ground will permit.

No leaves should be removed the first year, but in the following spring an ample supply may be obtained. In gathering for use the leaf-stalks should be bent down, and pulled, not cut off. The flower-stems, if seeds are not required, should be cut off soon after they make their appearance. Some well-decomposed dung may be dug in every year when the ground is stirred. Plantations will continue in good production for several years, but it is advisable to make a new one every fourth or fifth year, otherwise the produce is inferior in size and quality to that obtained from ground more recently planted. Some sorts of Rhubarb will, however, continue in good bearing for twelve years or more, if well supplied with manure.

Forcing.—Rhubarb is forced in the open ground, or in pits, cellars, or other structures, where a sufficient degree of heat is maintained. In the open ground forcing is frequently effected by covering the roots with Rhubarb Pots (fig. 161), boxes, or flower-pots, which are afterwards surrounded with hot dung or a mixture of litter, stable-dung, and leaves. Another mode which is pursued by the market-gardeners near London consists in digging long pits, to the depth of 2 or 3 feet, introducing 18 inches of hot dung, and then packing the roots closely together in fine soil, covering the crowns with hoops, or with 6 inches of straw, then hurdles or mats, and finishing with 6 or 8 inches of straw, the amount of the latter depending on the severity of the weather. In this way, provided the weather is dry, stout, tender, bright-red stalks are produced, and the leaf-blade is always small.

Fig. 161.
Rhubarb Pot.

These methods are, however, attended with considerable trouble and expense, and give the ground a littery and unsightly appearance; moreover, the quality of the produce is frequently much deteriorated by wet. For these reasons, forcing in houses is greatly to be preferred; not only is the heat more at command, but the quality of the produce is not influenced by the state of the weather. Rhubarb may be forced in any structure where a temperature of from 55° to 65° is maintained; a Mushroom-house, the floor of a vinery or Peach-house, or a pit, will be very suitable. Where there is

Fig. 162.—Clump of Forced Rhubarb.

not accommodation of this description, the roots may be placed on dung beds in a shed, or even in a warm cellar. The red-stalked varieties are greatly improved in appearance and quality when forced in the dark. Roots from two to five years old are the best for forcing, but in default of such, strong roots of one year's growth may be employed. The reason of the preference being given to the former is that they contain a greater amount of organizable matter for the formation of leaves and stalks. They may be taken up carefully any time after the decay of the leaves, and placed close together in the spot where they are to be forced. Some light soil should then be worked in among them, and a thin layer of soil spread over the whole, in order to retain a sufficient amount of moisture for vegetation. Afterwards, if the soil become too dry, a gentle watering may be given. No other care will be required. Sometimes the roots are taken up in autumn, potted, or more frequently packed close together in boxes, and kept in a shady situation till required for forcing, when they are placed in a Mushroom-house

or vinery. In this way, by bringing in a quantity of roots every three weeks, a constant succession is secured with little trouble.

Forcing may be commenced in the end of November, and continued till a supply is produced in the open ground. The older clumps are usually destroyed after they have been forced, but the younger ones may be replanted and forced again two years later.

CHAMPAGNE.—A superior early variety, producing good-sized straight stalks of a bright-crimson colour; flavour distinct.

EARLY SCARLET.—Stalks a deep-red colour; suitable for market-gardeners.

ELFORD.—Well adapted for forcing. Stalks slender, with a thin, bright-scarlet skin; red throughout when cooked, if not peeled, which is not necessary. Even when grown in the dark the stalks still preserve the crimson tinge.

GUAVA.—A variety of excellent quality, raised by Dr. Maclean.

LINNÆUS.—A very good early sort of fine quality. First-rate for main crop; very productive.

MITCHELL'S ROYAL ALBERT.—Very early; stalks large, red, and of excellent flavour.

THE SUTTON.—Resembles Victoria in growth, but comes earlier into use, and is practically a non-seeding variety—a very important point. The most striking merit, however, is its beautiful colour when young—a rich bright-red; and this characteristic remains after cooking, even when the roots have been forced in absolute darkness. The stalks are large and tender.

TOBOLSK.—Early, and good for forcing.

VICTORIA.—About a fortnight later than Linnæus; stalks rich-crimson, long and thick, of good quality.

ROCAMBOLE (*Allium Scorodoprasum*).—A perennial, native of South Europe. Its bulbs are milder than those of Garlic, and are used for similar purposes. The bulb consists of several cloves; but the stem, which rises to the height of about 2 feet, also produces a cluster of bulbils. The cloves should be planted 2 inches deep, in rows 8 inches apart, and 6 inches asunder in the row, in well-dug ground, in February or March, or after the leaves have died down in autumn. All the culture necessary is to keep the ground clean. When the leaves begin to decay, the bulbs should be taken up, dried in the sun, and stored for use. Some may also be drawn for use before they are full grown.

ROSEMARY (*Rosmarinus officinalis*).—An evergreen under-shrub, native of South Europe. Though not employed in cookery, this plant is grown in every kitchen garden. A decoction of the foliage is employed to relieve headaches, and is very efficacious in promoting the growth of the hair and in curing baldness. It is likewise used in the manufacture of Hungary water and Eau-de-Cologne. The sprigs are sometimes used as a garnish and for seasoning.

Rosemary requires a light dry soil and a warm sheltered situation. It is propagated by cuttings or rooted slips taken off in April or May, or by layers. The rooted slips may be planted at once where they are to remain. The cuttings, which ought to be 5 or 6 inches in length, should first be planted 3 or 4 inches deep in a rather shady situation, where they may remain till the beginning of September, by which time they will have taken root. They may then, or in the following spring, be finally planted 2 feet apart.

RUE (*Ruta graveolens*) (fig. 163).—An evergreen under-shrub, native of South Europe. The leaves have a nauseous smell, and a hot, bitter taste. They are sometimes employed as a garnish, and are administered to poultry affected with the roup. Also used as a popular medicine.

Fig. 163.—Rue (*Ruta graveolens*).

This plant grows well in any soil, but is not so liable to be injured by frost in poor soil as in a richly manured border. It may be propagated in March or April by seeds, cuttings, and slips; the last is the method generally adopted. The seeds may be sown in drills 6 inches apart, and raked in; and when the young plants are 3 or 4 inches high they may be planted out where they are to

remain. The cuttings, or slips, should be planted deeply in a shady border till they have taken root, after which they may be transplanted in rows 18 inches apart each way. It is advantageous to cut down a portion of the plantation every third year, to cause the production of young shoots.

SAGE (*Salvia officinalis*).—A hardy evergreen under-shrub, native of South Europe. The leaves are much used in cookery, and were formerly in demand for a decoction known as Sage tea.

Sage grows well in most soils and situations, but succeeds best in a light, warm, and rather dry soil. It may be raised from seeds sown on a gentle hot-bed in spring, and when the young plants are well-rooted they should be hardened off, taken up with balls, and planted 1 foot apart, in rows 18 inches asunder. Sage is, however, seldom raised from seeds, being generally propagated by cuttings or slips of the young shoots taken off in April, May, or June. The lower leaves should be cut off, the cuttings inserted in a shady border, and a hand-glass placed over them, or they may be planted at once in any vacant frame. Water must be given at planting if the soil is not sufficiently moist, and occasionally till they strike. They are then hardened off, and planted out at the distances previously indicated. It is a good practice to pinch off the extremities of the shoots to prevent the plants from flowering, and to induce them to throw out laterals and become compact bushes. The plants require an occasional trimming to make them grow close and bushy. The ground should be kept free of weeds, and stirred in spring and autumn. Sage will live for a long time in the same place; but as the plants become naked and straggling with age, a fresh plantation ought to be made every three or four years. In gathering, the young side and top shoots should be taken, and a quantity should be cut just before coming into flower and dried for winter use.

SALSAFY (*Tragopogon porrifolius*) (fig. 164).—A hardy biennial, native of Europe. It is cultivated for its long, tapering, fleshy root, which is yellowish outside and white inside, larger than that of Scorzonera, and not so liable to fork. The roots are scraped, cut into pieces, and steeped for a while in vinegar; they are then boiled in water like Parsnips, and served up with melted butter, white sauce, and in various other ways. They are also fried in butter after boiling, and served with Parsley. The stalks are sometimes cut when 4 or 5 inches long, and dressed as Asparagus, and in this way they are excellent.

Salsafy requires a free rich soil which has not been newly manured, and an open situation. The ground where it is to be grown should be trenched 2 feet deep in autumn, or at least dug two spades deep in order that long straight roots may be formed.

The seeds should be sown thinly in drills 1 inch deep and 1 foot apart. A first crop may be sown in March, the main one the end of April, and a small sowing the end of May to come in a little later. In dry

Fig. 164.—Salsafy (*Tragopogon porrifolius*).

weather the seed-beds should be copiously watered to induce germination. When the young plants are 2 or 3 inches high, they may be thinned out to 8 inches apart in the row. The ground should be hoed occasionally and kept free of weeds. If extra fine specimens are desired holes may be bored with a long dibber 12 inches apart each way and filled up with old potting soil, thinning out one plant to each in the centre. This treatment on heavy soils gives good results. In October and November roots may be drawn for use, and at the approach of frost some may be taken up and stored in sand for a supply during winter. The roots left in the ground will be fit for use

throughout the spring till they run to seed, when they become tough, woody, and useless. The flowers appear in May and June, and seeds are ripened in autumn.

SAMPHIRE (*Crithmum maritimum*) (fig. 165).—A hardy perennial, native of Europe,

Fig. 165.—Samphire (*Crithmum maritimum*).

including Britain, where it grows naturally on rocks near the sea. The stem is about a foot high; the leaves are lanceolate and fleshy, and the flowers are yellow. The leaves, pickled in vinegar, are used in salads and as a seasoning. The plant is difficult to cultivate in gardens, and the produce is never so good as that obtained from the places where it naturally grows. Propagated by division, or by sowing seeds in April, or in autumn soon after they are ripe; the latter period is preferable, for if kept till spring the seed do not germinate so well.

Samphire succeeds in a light sandy or gravelly soil, kept constantly moist, and sprinkled occasionally with a little sea-salt or barilla, or watered with a solution of these substances in order to supply the plant with soda, which is a necessary element of its food. It will grow still better if planted or sown among stones at the foot of walls, with a south or east aspect; this, and an occasional watering with a solution of sea-salt, will give conditions nearly the same as those under which the plant naturally grows. As it is rather delicate, and liable to be injured by frost, it should be protected with dry litter or leaves during the winter. Towards the end of summer, leaves may be cut for pickling. The seeds resemble those of Fennel, but are larger; they ripen in autumn, and do not usually germinate when over a year old.

SAVORY (*Satureja*).—The aromatic tops of Savory are put into salads and soups; they are also boiled along with Peas and Beans.

Two species are cultivated—Summer Savory and Winter Savory.

Summer Savory (*Satureja hortensis*) is a hardy annual, native of South Europe. It is raised from seeds, which should be sown on a warm border in April in shallow drills 1 foot apart, thinning out the young plants when 2 or 3 inches high to 6 inches asunder in the rows: the thinnings may be planted at the above distances, and watered at planting, and till they take fresh root. When just coming into flower, a quantity should be pulled up, dried in the shade, and preserved in packets for winter use.

Winter Savory (*Satureja montana*) is a hardy evergreen under-shrub, also native of South Europe. It may be raised from seeds sown in April, but is generally propagated by dividing the plant in March or April, or by cuttings of the young shoots taken off in April and May, and planted on a shady border. When well-established they may be planted out 1 foot apart in rows 15 inches asunder. Some may also be planted as an edging. The plants should be trimmed every year in autumn, and the ground between the rows occasionally stirred, care being taken not to injure the roots. Fresh plantations should be made before the plants grow old and cease to produce leaves freely.

SAVOY (*Brassica oleracea bullata*).—The Savoy differs from other Cabbages in having puckered or crimped leaves, which form one large, usually wide-spreading head with a hard, often large "heart"; the stem is short.

The Savoy succeeds best in a moderately rich soil, neither very stiff nor too highly manured, and in an open situation. For a supply in the end of autumn, and throughout the winter, three sowings will generally be sufficient; namely, one towards the close of February for an early crop, another in mid-March, and a third in mid-April. Sometimes also some seeds are sown in the beginning of August for plants to come in early the next autumn; but in spring a sowing of some early sort, such as the Earliest of All, is preferable.

The ground for the seed-bed having been prepared, the seeds are sown in drills in an open situation, where the soil has been thoroughly dug and raked. The beds should be securely netted against birds.

When the young plants have made two or three good leaves, they should be pricked out 3 inches apart into nursery-beds. In May some of the most forward plants of the early sowing may be planted out for use in September if this vegetable is required so early; the remainder may be transplanted in the course of the month of June. The main crop and latest sowing may be planted out in July and August, when rain is likely to fall. In all cases the strongest plants should be selected.

On taking up the plants, their roots should be examined in order to ascertain whether they are clubbed or not, and all that exhibit any signs of that disease should be rejected. The distances at which the plants may be placed varies with the sort and the nature of the soil; less space being required in poor than in rich soil. Small kinds, like the Early Ulm, may be planted 18 inches each way; whilst for the Large Green and similar sorts the distance should be increased to 2 feet each way. Sorts of medium growth may have the above distance between the rows, whilst 18 inches may be allowed between the plants in the rows. After planting, if the weather be dry, the plants should be watered, and this ought to be continued till they are again established; afterwards all the culture required is confined to hoeing the ground occasionally.

Except in very severe winters, Savoys do not require protection from frost; sometimes, however, the plants are made to incline towards the north, and the earth taken from that side placed over the roots on the opposite side. The late crop remains fit for use till the end of February or later.

Seeds are saved in the same way as advised for the Cabbage; they ripen in the months of July and August.

The principal sorts are :—

Best of All.—A superior Savoy of the Drumhead type. Hearts solid and well formed; suitable for large establishments. The chief merit of this variety is its excellent table quality, in which respect it resembles the better garden Cabbages.

Dwarf Green Curled.—Stem dwarf; leaves deep-green, very rugose, much curled at the margin; hearts well, and is very good, especially when mellowed by the first frosts in autumn.

Earliest of All.—The earliest Savoy in cultivation. Seeds sown on March 20 produced a fine crop ready for cutting about August 5. Hearts conical in shape, close and compact; leaves pale-green; very tender and sweet.

Early Ulm.—Heart small, round; outer leaves forming a cup, with the edges rolled a little outwards, of a deep-green colour. It hearts quickly, is of excellent quality, and is a good second early sort.

Large Green German (Drumhead).—The largest Savoy, and one of the best. The leaves are plainer than in the other varieties; the heart roundish, a little flattened, like a Drumhead Cabbage. It withstands frosts very well.

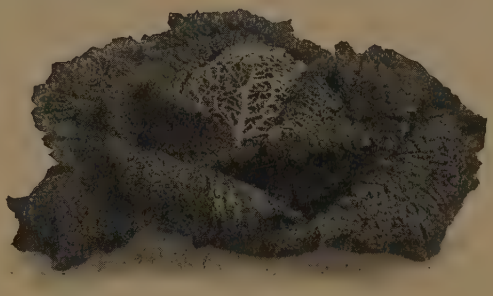

Fig. 166.—Savoy—New Year.

New Year (Sutton's) (fig. 166).—A recent introduction of great merit. Attains a large size, is beautifully curled, and will stand the severest weather.

Perfection (fig. 167).—Has the best points of older varieties, but surpasses them all in degree of excellence. The plants are not more than 9 inches high, having but few outside leaves, which are beautifully curled.

Sugar Loaf.—A very distinct and good Savoy,

Fig. 167.—Savoy—Perfection.

which deserves to be grown in every garden. It is early and attractively curled.

Tom Thumb.—One of the smallest Savoys known. Hearts compact, and delicate in flavour. Especially useful in gardens of limited extent, as it may be planted a foot apart each way.

SCARLET RUNNER (*Phaseolus multiflorus*).—A half-hardy perennial, native of South America. Being commonly grown in cottage gardens, both for use and ornament, it is well known to every one, it being one of the most popular of pod-bearing plants, as it gives an abundant supply of an excellent vegetable food in summer and autumn. It is not generally known that the

plant is a perennial, having tuberous roots like the Dahlia; and that these, after having been preserved through the winter in a dry place out of the reach of frost, and planted out in spring, will yield a crop earlier in the season than that afforded by plants raised from seeds. It may be observed that these roots are poisonous.

Cultivation.—The soil should be rich, rather deep, not dry and thin, and by no means cold and wet. As the plants are too tall and rambling for borders, the seeds should be sown in the open quarters; and as they are not required so early as Kidney-Beans, which are better adapted for affording an early supply, the crop of runners need not be risked by sowing too early.

During a hot and dry summer abundance of moisture must be supplied to the roots, and overhead syringing is beneficial during the growing period, and in all cases trenches should be prepared as for Celery, and the seeds sown over these. In the preparation of the trenches it is always advisable to leave a shallow trench, as this renders watering and mulching a comparatively easy matter, every drop of water, sewage, or other liquid manure applied reaching the roots.

The first week in May will be soon enough for the first sowing. If the seeds germinate well, and are likely to go on favourably, another sowing need not be made till the middle of May, when the weather is favourable. Two sowings are generally sufficient, as these will afford green pods till the plants are destroyed by frost.

Scarlet Runners are grown in various ways. A common method in the large market-gardens near London is to sow at from 8 to 12 inches apart, in rows 3 or 4 feet asunder, according to the richness of the soil. The plants are not supported by sticks, but kept dwarf by pinching or cutting off the tops at the second or third joint, all other running shoots being also kept closely snipped off with a pair of scissors or the finger and thumb. Unless this stopping is very closely and persistently practised, there will soon be a thicket of growth and very few pods produced. A mulching of strawy litter keeps the pods from being badly splashed and also prevents the soil from drying.

For private gardens the plan of growing these Beans in rows at wide distances apart and trained on tall stakes is the best. Under liberal culture they attain a great height, or as much as 20 feet, and in some instances they are actually given stakes 12 feet and upwards in height. These tall stakes, with their heavy burden, are, however, liable to be blown about by strong winds, and, moreover, very high steps are needed to gather the pods. As a rule strong stakes, from 9 to 12 feet out of the ground, and well braced together near the tops with the aid of other stakes and tar twine, are more to the purpose, and the rows in this case should be not less than 9 feet apart. This may seem somewhat extravagant, but two rows of early Spinach or Lettuce, or of Cabbages and Cauliflowers, could be planted early between the rows of Beans, or what are intended as such, while the latter will crop all the more heavily for having plenty of room.

Another method is largely adopted, especially in gardens where space is limited. A row of Beans is grown on each side of a walk about 18 inches from the edge of the path, and tall stakes are fixed, so that the tops come together, forming an arch. About 15 inches should be allowed from plant to plant. Thus grown, Scarlet Runners are a pleasing object in the garden.

The sticks require to be strong, otherwise, when loaded with the plants, high winds sway the whole to one side. In many cases such sticks cannot be procured; when this is the case it is a good plan to sow in patches or circles of about 2 feet in diameter and 6 feet apart, six seeds being placed in the circumference of each circle. Three sticks, on which the branches and twigs are retained, should be stuck in at three equidistant points, just outside the circle, and their tops brought together and tied. Secured in this way, the sticks will afford good support. The ground can also be planted with some crop, such as Broccoli, between the Beans.

Runner Beans transplant readily, and a few should be grown in pots or boxes in heat, to be planted in prepared trenches towards the end of May in single rows, allowing 12 inches from plant to plant, and supporting them on single upright stakes. Early rows should be protected with cotton netting, canvas, or mats.

If the roots are packed away like Dahlia roots, and replanted in March, 6 inches apart, in rows 5 feet asunder, they are likely to yield a crop much earlier than plants raised from spring-sown seeds. This is, however, rarely resorted to, except in the case of new varieties.

When the plants are growing slowly, or whilst the soil and air are colder than is congenial to them, they will not require much water; but when in vigorous growth, and the pods are forming abundantly, plenty

of water should be supplied, but not from a cold spring. Earth should be drawn to the stems, as directed for Kidney-Beans. In training straggling shoots to any support that may be employed they should be directed from right to left, or contrary to the course of the sun. If turned otherwise they will not go on. Gathering the crop and saving seeds are conducted as for the Kidney-Bean.

CHELSEA GIANT WHITE.—Remarkable for its free-cropping habit and continuous bearing, as

Fig. 168.—Scarlet Runner.

well as for its gigantic, thick, fleshy pods, often measuring 15 inches in length, which are proportionately broad and of splendid table quality.

MAMMOTH SCARLET.—Surpasses all the older sorts in size and quality. It is abundantly prolific, bearing in clusters enormously long, broad, thick fleshy pods of a dark-green colour, which when cooked are particularly tender.

NE PLUS ULTRA.—Flowers scarlet; pods long, perfect in form and of excellent quality. A heavy cropper; a favourite with growers for market.

PAINTED LADY.—Flowers bright-scarlet and pure-white; very ornamental; but as regards quality and productiveness is scarcely equal to Scarlet Runner.

PRIZE-WINNER.—Pods of first-rate quality; a good exhibition variety, very productive.

SUTTON'S A1.—This can easily be distinguished from other varieties by the darker colour of its leaves and flowers. The deep-green pods, which hang in great clusters, are straight, fleshy, and of immense size; when cooked they are tender and of excellent quality.

THE MARVEL.—The pods, which are from 6 to 8 inches long, are produced in clusters of 5 or 6 from almost every axil. A most prolific cropper.

WHITE RUNNER.—A variety with white flowers and seeds; it does not continue long in flower and bearing; its ripe seeds are preferred as a vegetable to those of the Scarlet.

SCORZONERA (*Scorzonera hispanica*) (fig. 169).—A hardy perennial, native of Spain. The root, for which the plant is cultivated, is Carrot-shaped, black outside

Fig. 169.—Scorzonera (*Scorzonera hispanica*).

and white inside. It is cooked in the same way as Salsafy.

Scorzonera succeeds best in a light, deep,

free soil, and an open situation. It is raised from seeds sown in drills 1 foot apart, and covered to the depth of ½ inch. As it is apt to run to seed if sown too early, and consequently to become tough and woody, it is better not to sow till the second or third week in May in the hotter parts of the kingdom; elsewhere it may be sown in the end of April. The young plants, when 3 or 4 inches high, should be thinned out to 8 inches asunder in the rows. In September, some of the roots will have attained sufficient size to be drawn for immediate use; others will come in for use in October and November. In the latter month they will be in perfection, and before frost sets in a quantity may be taken up and stored in sand for a supply during its continuance. At other times the roots remaining in the ground will afford a supply throughout the winter and spring, and will continue fit for use till April or May, about which time the plants begin to run to flower. Before this takes place any roots remaining in the ground should be taken up and placed in sand. The seeds ripen in autumn, and are best when saved from plants two years old.

SEA-KALE (*Crambe maritima*) (fig. 170).—A hardy perennial, native of Europe, including Britain, where it grows on the sea-coasts. It has been cultivated for more than a century, but most extensively within the last fifty years. Formerly the green leaves were used boiled as greens; but now the young blanched shoots are the parts used, and the chief aim in its cultivation is to produce them large, crisp, and well blanched.

Soil and Situation.—The situation for a plantation of Sea-Kale should be open to the sun, and not under the drip of trees. The best soil is a rich, deep, sandy loam, but the plant will succeed in any good garden ground that is not stiff. The kinds of manure here recommended for Asparagus will also be suitable for Sea-Kale. The ground should be trenched to the depth of from 2 to 2½ feet, and according as it is poor or rich, more or less farmyard or other manure should be well incorporated with it.

Cultivation.—Sow in rich soil in March, or as early in April as possible, in rows 1 foot asunder, and thin the plants to 6 inches apart in the rows. Stir the ground, and keep the plants clear of weeds during the season. Towards midsummer, a sprinkling of salt or of nitrate of soda may be applied with beneficial effects. Either of these salts may be sown over the leaves of the plants as well as on the ground, and no injury will result.

In the following March, the ground being trenched and duly prepared, commence at 2½ feet from the side of the quarter, and mark three rows at 2½ feet apart. Then a 3-foot space should be allowed; and again three rows should be marked off at 2½ feet apart, and so on. If ground is scarce, it will nevertheless be advisable to retain the distance of 3 feet between every third and fourth row; but between the others an interval of only 2 feet may be allowed. This distance will also be proper for a plantation which is to be forced, only the plants should be 2 feet apart in the row, in order to admit of blanching pots being placed over them.

When the plants are taken up, the top of each with all the crown-buds should be pared off. If this precaution be not taken, the plants would be apt to run to seed in the first summer after planting; but when the crown is cut off, several buds will push which will not have this tendency. A trench about 1 foot deep should then be made by the side of a line, and the plants inserted so that their crowns may be about 2 inches below the surface. Watering after planting is not required, at least till the plants have struck fresh root.

After planting, the growth of the plant should be promoted as much as possible, and with this view a mulching of rotten dung may be applied, or liquid manure may be occasionally given. The flower-stems, if any push, should be cut off as they appear. Buds will be formed in the axils of each leaf, and in the spring of the second year of planting they will form a sprout which becomes fit for use when blanched, and of course the larger and more vigorous it is the better. Its strength greatly depends on that of the bud, and this again on the size of the leaf in the previous autumn; efforts should therefore be made to grow only large leaves. In order to do this it is advisable to make an early removal of some of the weaker ones, so that a limited number may have more light and air. If some very large sprouts are intended to be grown, the plants should be kept far apart. In the autumn the leaves should be removed as they decay, and, when all are cleared off, the ground should be forked over, and a covering of leaves 6 or 8 inches thick placed over the plants, and on this some litter should be put, to prevent the leaves from being blown away. If leaves are not at command, the

plants may be covered with a layer of light soil, and by this means they will be blanched, though not forced.

Instead of sowing the seed in a nursery-bed, and transplanting the year-old seedlings, some prefer sowing in patches, at the proper distances, where the plants are to remain for produce. This is certainly the more natural mode, and well-established plants can be obtained by it; the only objection is the loss of the ground for a year. The plants should be allowed to follow their natural mode of growth during the first summer; but after the winter is over, the crowns of every plant should be pared off, as was recommended in transplanting, to prevent the formation of flowering stems. In the second spring after sowing a portion may be forced or merely blanched if required.

Plantations are now generally made from root cuttings, for any part of these will push shoots and form a plant. The extremities of the roots of plants taken up for forcing in November, or subsequently, answer very well. Being the younger portions of the roots, they ultimately make better plants than would result from transplanting the older and thicker parts. These *thongs*, or extremities of the roots, should be taken only from healthy plants, and should be about 4 inches in length, cut flat at the top or thickest end and slanting at the other end, and then tied in bundles of fifty. By the middle of April they will have commenced sprouting and forming roots, when they ought to be planted with a dibber 15 inches apart in rows 20 inches apart, taking care to sink them just below the surface. Most of the cuttings will attempt to push out several sprouts, but these must early be thinned to a single growth in each case, otherwise the crowns will be small. Should the weather be dry during the first few days after planting, water ought to be given, but after they are once growing strongly, merely keeping the surface of the ground free of weeds by means of an occasional hoeing will be all that is needed to produce fine crowns for lifting and forcing; they may be lifted and stored in sand or moist soil till wanted, or until planting time in spring.

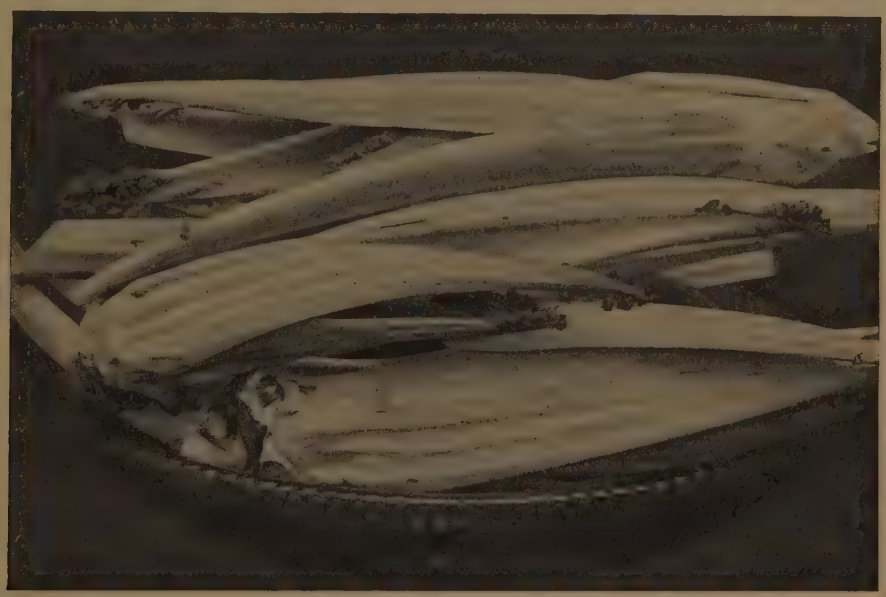

Fig. 170.—Sea-Kale (*Crambe maritima*).

Forcing.—Sea-Kale is easily forced either in mild hot-beds, frames, benders and mats, or in Mushroom-houses, where it can be kept in darkness. Batches of roots can every few days be packed together closely in rich loamy soil, and will produce fairly strong growths in the course of about three weeks—more or less according to the heat kept up. If placed near to hot-water pipes the soil should never be allowed to become dry, and a second cutting of serviceable growths may then be had.

A little heat is sufficient to excite vegetation, for, with a mean temperature of 42°, it pushes naturally in the open ground, and when the mean of the air and of the soil

reaches 55°, the growth is as vigorous as can be desired, and therefore, in forcing, this mean temperature ought not to be exceeded. In cases of emergency, when produce must be had in a certain limited period, 60° may be applied; but this should be the maximum.

If forcing is to be carried on where the plants are established in the open ground, the soil ought not to be allowed to get frozen in the autumn or winter previous to forcing. It is easy to prevent this by a covering of litter; but if the soil is allowed to get frozen, it takes much heat to raise the temperature to even 42°, which we may term the starting-point in forcing this vegetable, for at this temperature it will be in a manner dormant. Top and bottom heat should correspond, for at the time of the year when Sea-Kale pushes naturally, the average temperature of the air and that of the earth very nearly correspond. In commencing to force we may raise the bottom-heat 5°, or to 47° the first week, to 50° the second week, and then increase it by 1° a week till produce fit for cutting is obtained, which will be in the course of six or seven weeks from the commencement of the process.

The time to commence forcing depends on the period at which produce will be required. If this should be the third week in December, from plants forced in the open ground, they must be cleared of decaying leaves in the end of October, and the soil about the crowns forked over and made fine. A portion of the plants may be covered to the depth of several inches with light soil, sand, or coal ashes, and a succession to those which are not so treated will by this means be secured. The others should be covered with Sea-Kale pots (fig. 171), or large garden pots, and over these must be laid a covering of stable manure, or, preferably, a mixture of manure and leaves.

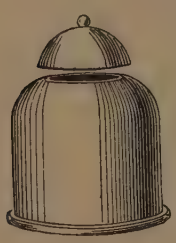

Fig. 171. Sea-Kale Pot.

Taking the Crop.—The blanched sprouts should be cut when they are from 3 to 6 inches in length, and whilst crisp, stiff, and compact; they should not be left till they are drawn up so as to bend or hang down. The soil or other material used for excluding the light should be carefully removed so as to expose the stem of the sprout, and the latter should be cut a little below the base of the petioles, and just enough to keep these attached. After the crop has been taken the plants should be exposed and the shoots thinned to 3 or 4 crowns on each plant.

To save Seeds.—Select some strong plants, and allow them to take their natural growth, without cutting off the crowns, or blanching. When the seeds are ripe, collect the pods, dry them, and put them into open canvas bags. The seeds keep best in the pods.

Varieties.—Formerly there was only one form, the Purple-tipped, but we now have the Lily White variety of this. In some respects the latter is a great acquisition, inasmuch as it requires less blanching, the tips being creamy-white, while the flavour is also more delicate than is the case with the old form. Unfortunately the Lily White is less hardy, and the crowns should either be protected from frosts where grown, or else be early lifted and stored for use as required.

SHALLOT (*Allium ascalonicum*).—A hardy perennial, native of Palestine, near Ascalon; hence the specific name. The bulbs, which are milder in flavour, and do not possess such an offensive odour as those of Garlic, are used in a raw state for flavouring steaks and chops; they are also boiled

Fig. 172.—Shallot.

in soups, stews, and some other dishes, and are excellent when pickled.

The Shallot requires the same treatment as Garlic. In recently manured and damp ground it is liable to be attacked by the maggot and a kind of mould; and in any case it is well, in planting, to leave the points of the bulbs a little above the surface. A small plantation may be made from the middle of October to the middle of November, in order to produce bulbs in June and July, but the principal crop should not be

planted till February or the beginning of March. When the roots have taken good hold of the ground, it is a good practice to remove the earth from about the bulbs, so as to leave them wholly out of the ground. In July or August, when the leaves turn yellow, the bulbs should be taken up, and, after having been dried in the sun for several days, they should be placed in nets, or tied up in ropes like Onions, and hung up in a dry airy room from which frost is excluded.

The varieties are :—

Common.—Leaves small, in close tufts, about a foot in length. Bulbs long-oval or conical, reddish-yellow. Early and long-keeping. It seldom runs to seed.

Grosse Echalote d'Alençon.—Bulbs of the same shape and colour as those of the Jersey Shallot, but larger and later in forming; the leaves are longer and more glaucous. The largest kind, but it does not keep well.

Jersey or Russian.—Leaves short, very glaucous. Bulbs round, small-necked, yellowish-red. The earliest kind, but apt to run to seed when planted in autumn.

SKIRRET (*Sium Sisarum*).—A perennial, native of China and Japan. The root, which is the part used, is composed of several prongs about the thickness of a finger. They are boiled, and served in the same way as Salsafy and Scorzonera. The plant is little cultivated. It succeeds best in a free, rich, deep soil, and in an open situation. It is generally raised from seeds, but may also be propagated by side shoots in spring. Seeds should be sown about the end of March or in April, in drills 1 foot apart. In dry weather the bed should be watered, and when the young plants are about 2 inches high they may be thinned out to 6 inches asunder. Some of them may be taken up young in September, and they will be in perfection in November, and continue so till the plants begin to exhibit signs of pushing up flower-stems, when they should be taken up and stored in sand. The flowers, which are white, appear in July and August. The seeds, which ripen in autumn, should only be saved from the plants which flower the second year.

SORREL (*Rumex*).—The leaves of Sorrel are used in soups, salads, and sauces, especially on the Continent, where they are also used as a substitute for Spinach.

Sorrel grows well in almost any soil, but succeeds best in one that is rich, deep, and rather moist. All the sorts may be propagated by dividing the roots in March or April, and this method is that which must be adopted in propagating the diœcious kinds when male plants are required. The best plants are obtained from seeds sown in drills, on well-dug ground, raked fine, and covered with fine earth to the depth of ½ inch. The distance between the drills may be 15 inches for the small-leaved sorts and 18 inches for the large-leaved kinds. When the young plants are 2 or 3 inches high they should be thinned out to 1 foot apart in the row, and the thinnings may be planted at the above distances, water being given at planting, and afterwards till they take root. About two months after sowing, some of the leaves may be gathered. In doing this, the plants are generally cut over; but the market-gardeners near Paris prefer gathering the leaves singly, always taking those which are full grown, leaving the younger to increase in size; and this is the best plan. As the acidity of the leaves is increased in the heat of summer, a small quantity to come in for use at that season should be sown or planted in a shady and rather moist border. All the care necessary is to hoe the ground between the rows occasionally, to fork it in spring or autumn, and to take up the plants, divide, and replant them every three or four years, or less frequently if they are growing vigorously and produce full-sized leaves.

Three species and several varieties are cultivated :—

Common Sorrel (*R. acetosa*).—A perennial, native of Britain, where it grows naturally in meadows and pastures. The varieties are :—Common Garden Sorrel, Belleville Sorrel (fig. 173), Blistered-leaved Sorrel. The second sort is the best, and is the kind generally cultivated near Paris.

Fig. 173.—Belleville Sorrel.

French or Round-leaved Sorrel (*R. scutatus*).—A hardy perennial, native of France and Switzerland. Its stem is from 12 to 18 inches high; the leaves are roundish, heart-shaped, entire, glaucous, and smooth.

Mountain Sorrel (*R. montanus*).—A hardy perennial, native of Europe. There are two varieties, the type and the Green Mountain, both

of French origin. The leaves of the first sort are slightly blistered, larger than those of the Common Sorrel, of a paler green, and not so acid. The leaves of Green Mountain possess much acidity, are of darker green, larger, more abundant and earlier in spring.

SPINACH (*Spinacia oleracea*). — An annual, supposed to be a native of Northern Asia.

The soil for Spinach should be deep and rich, neither very stiff nor very light. The ground for the summer sowings should be rather moist, otherwise frequent waterings will be necessary; whilst for the winter crops a dry warm spot must be selected. In all cases the ground should be deeply dug, and if necessary manured with stable-dung. Blood, guano, and other nitrogenous manures are also used.

The first sowing may be made in the middle of February, and from that time a small quantity should be sown every three weeks till May, and then every ten days till August if a constant supply is required, for the summer crops soon run to seed. In the first week in August, and again in the third week of that month, the principal crop of Flanders and Lettuce-leaved for winter use should be sown; and lastly, another sowing of the same varieties may take place in the beginning of September. The sowings for summer use should be made in a somewhat shady situation, with the view of preventing the plants from running to seed so soon as they otherwise would. Frequently the summer crops are sown in a single drill between rows of Peas or Beans; in this way they do very well, and in rich soil do not injure the plants between which they are grown.

The ground having been deeply dug, the seeds should be sown in drills about 1 inch

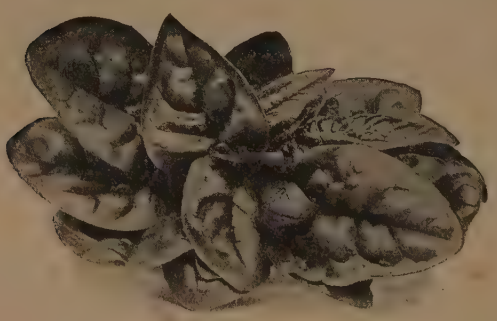

Fig. 174.—Spinach—the Carter.

deep, 12 inches apart, but for the Flanders and Lettuce-leaved varieties from 15 to 18 inches between the rows may be allowed. The winter crops are also frequently sown broadcast, in 4- or 5-foot beds, with 1-foot alleys between. Previous to sowing, if the ground is dry, the drills should be well

Fig. 175.—Spinach—Winter (Prickly-seeded).

watered. It is also advantageous to steep the seeds before sowing for five or six hours, when their speedy germination is desired; but in this case they must not afterwards be allowed to get dry, nor suffer from want of water.

After sowing, the seed-bed should be frequently watered in dry weather. When the young plants have made three or four leaves, they should be thinned out to about 2 inches apart; afterwards, when rather further advanced, they may be thinned out to 6 or 9 inches apart in the rows. Some, before thinning the summer crops a second

Fig. 176.—Giant-leaved Winter Spinach.

time, make a first gathering, and then cut out every alternate plant. After thinning, the culture is confined to keeping the ground clean, stirring occasionally, and watering frequently and copiously in dry weather. In gathering for use, the largest leaves should be taken off first, either by cutting or picking, the others being left to produce in succession; but during the heat of summer the plants may be cut over.

The varieties are few.

PRICKLY-SEEDED (Winter) (fig. 175).—Readily distinguished by its seeds being prickly. Leaves smaller and thinner than those of Flanders and Lettuce-leaved, to which varieties it is inferior in everything but hardiness.

CARTER'S GIANT-LEAVED WINTER SPINACH (fig. 176) is useful on cold backward soils.

SUMMER (Round).—Leaves large, roundish, and thick. This sort is adapted for summer use; all the others for winter supply. In consequence of its soon running to seed it requires to be sown frequently.

THE CARTER (fig. 174).—Leaves very large, of a fine colour and of far greater duration than ordinary Spinach; one of the best for summer use.

SUN ROOT (*Helianthus tuberosus*) (fig. 177).—Formerly known as the Jerusalem Artichoke, this is a hardy tuberous-rooted perennial, closely related to the common Sunflower.

Sun Root—Jerusalem White. Fig. 177. Sun Root—Veitch's Improved Long White.

It produces numerous fleshy tubers which are baked, roasted, or boiled, and served with milk or butter, and in various other ways. They are much liked by some persons, and their flavour, when properly cooked, is agreeable. The plant is also sometimes grown near preserves, for the winter-feeding of pheasants, which are very fond of the tubers.

The Sun Root was one of the many plants recommended as a substitute for the Potato, and it is probably the best that has as yet been proposed. It is much more hardy than the Potato, as easily cultivated, thrives in the poorest soil and in the worst situations; and the nutritive value of the tubers is very considerable. Sutton's New White is an improved form with tubers of better flavour and more taking appearance than the old purple form.

It grows well in a sandy loam, in an open situation. It is propagated by planting small tubers, or pieces of larger ones, each piece being furnished with two or three eyes. Previous to planting, the ground should be deeply dug or trenched, and manured if necessary. The sets may be planted in the end of January, or February, either in shallow trenches 4 or 5 inches deep, or in holes made to that depth with a dibbler. They may be placed 1 foot apart, in rows 2 feet asunder. The rows should run north and south in order to admit the sun's rays, which would otherwise be to a great extent excluded by the luxuriant foliage of the plants facing the south. After planting, with the exception of hoeing the ground occasionally and drawing a little earth to the stems, nothing further is required till November, when the tubers will be fit to take up, to be stored in sand, for use in winter; but as they are not injured by frost, and keep best in the ground, the greater portion of them may be allowed to remain, to be taken up as wanted; if, however, the ground is required for other purposes, the whole crop may be taken up and pitted like Potatoes. In digging them up, which is best done with a fork, care should be taken to remove all the tubers, as any that are allowed to remain will spring up when the growing season arrives; for this reason the plant is not easily eradicated from where it has once been grown. A fresh plantation should be made every year.

TANSY (*Tanacetum vulgare*).—A hardy perennial, a native of Europe. The young aromatic leaves are employed in colouring and flavouring puddings, &c.

Tansy may be raised from seeds sown in spring, or by division of the roots in autumn. By topping the plants before they come into flower the production of young leaves will be encouraged. The plants will thrive for many years in the same place.

TARRAGON (*Artemisia Dracunculus*).—A perennial, native of Siberia. The aromatic leaves and tops are used in salads and soups, are pickled with Gherkins, and an infusion of them in vinegar forms the much-esteemed Tarragon vinegar.

Tarragon requires a free, light, somewhat dry soil, and a warm situation. It is propagated by dividing the roots in March or April, planting them in deeply-dug ground, 8 inches apart, in rows from 12 to 15 inches asunder, covering the roots with soil to the depth of 2 or 3 inches. It may also be propagated by cuttings of the shoots, taken off in July or August, planted under a hand-glass, and transplanted when they have made good roots, water being given at planting and until they are established. As the plants are liable to be injured by severe frost, it is a good plan to cut them down at the approach of winter, and to cover the crowns with a little mould and then with litter. In spring the ground should be slightly stirred, but not so deeply as to injure the roots. A fresh plantation should be made every year; for Tarragon, though a perennial, is apt to die off in this climate, seldom lasting good for more than two or three years. Roots lifted and placed in boxes of light soil force readily, but where not forced in winter, a quantity of matured growths should be cut and dried for use in that season.

THYME (*Thymus*).—The leaves and tops of Thyme are extensively used in soups and stuffings, for which purposes two species are cultivated, namely, Common Thyme (*Thymus vulgaris*) and Lemon Thyme (*Thymus citriodorus*).

Thyme is a most aromatic herb. It thrives best when planted in a light, rich, and rather dry soil, and in a warm situation. The best plants are raised from seeds sown in April, on a bed of light earth raked fine. They may be sown in shallow drills 8 inches apart, or in a single drill to form an edging; in either case covering lightly with earth. The seed-bed and the young plants, when they come up, should be watered occasionally in dry weather. They may be thinned out in June or July to 4 inches apart; or, if sown in drills, to about 3 inches apart in the row. The thinnings may also be planted, water being given at planting, and subsequently till they take root.

Old plants may be divided in March or April, and rooted branches may be taken off and planted at the same period, in both cases watering at planting. Branches may be induced to take root by bending them down and covering the lower portion with earth, when they will soon take root.

Thyme is frequently planted or sown as an edging, and answers the purpose very well; but after the lapse of three or four years, or when the edging commences to exhibit gaps, the plants should be taken up. When coming into flower a quantity should be cut, or pulled up, and dried for winter use.

TOMATO, or LOVE APPLE (*Lycopersicum esculentum*).—A tender annual, native of South America, now very extensively cultivated for its fruit. In addition to their having become almost indispensable as a daily article of diet, the fruits also possess medicinal properties which render them particularly desirable as a remedy for affections of the liver and other organs where calomel is prescribed. This ever-increasing demand has led to the establishment of a very important industry in this and other countries, thousands of workers now being almost solely occupied in producing the requisite supplies. Extensive trials of Tomatoes are held periodically in the Royal Horticultural Gardens at Wisley, and the reports published in the Journal of the Society have been of considerable assistance in the preparation of this chapter. Upwards of one hundred varieties of Tomatoes, more or less distinct, are now in cultivation.

Our climate is too uncertain for any great reliance to be placed on open-air crops of Tomatoes. In a hot dry summer they succeed admirably, not only against sunny walls and fences, but also quite in the open, with no extra shelter, and only a stake to each plant.

By starting with strong plants, and striving to keep them growing and setting crops rapidly, it is possible even in an ordinary summer to get a good crop, the bulk of which may ripen before bad weather sets in, or disease works havoc among the plants. When house-room was more limited, the old-fashioned plan of raising the plants early, and gradually shifting them on into 10-inch pots with a view to having a crop already set on them before placing them

outside against a sunny wall, answered well, and is still to be recommended, especially seeing how slowly and indifferently the fruit ripens under the shade of Vines. Nowadays those who must have Tomatoes in abundance nearly or quite all the year round have houses devoted chiefly to their culture, and the open-air crop is not relied upon other than as supplementary.

Unless the plants can be kept growing moderately strongly, it is a mistake to raise them as early as is usually advised, starvelings being very slow in attaining a healthy

When they have formed two leaves above the cotyledons, either plant them singly in the centre of 3-inch or 4-inch pots, or in pairs against the sides of 6-inch pots. Light loamy soil, previously warmed by means of hot bricks plunged in the heap, should be used, and the plants ought to be buried up to their seed-leaves. If they can be given the benefit of bottom-heat and a little shade they will quickly recover from the check given, but if the house or pit can be kept at from 60° to 70°, bottom-heat may be dispensed with. Water carefully at first,

Fig. 178.—Tomatoes: an open-air crop (Perfection).

productive state—if ever they do. Late in March, or the first week in April, is soon enough to sow the seed, and the preference should be given to moderately strong-growing, free-setting, early-maturing varieties.

The seeds should be sown thinly in well-drained 6-inch pots, or in pans and boxes, using light sandy soil, and place on or plunge in a mild hot-bed, or, failing this, on a bed or staging in a forcing house or frame of any kind. If the soil is kept uniformly moist the seedlings will appear in a week to ten days. Before they become leggy, raise them up to the light in the same house, pit, or frame, and thin out if necessary.

especially where the larger pots are used; but when they are growing strongly much more water will be needed, and the plants must also be raised well up to the light to prevent them from becoming leggy. When small pots are used the plants should be shifted again into 6-inch pots, otherwise they quickly become root-bound and starved. On the whole it is better to place the seedlings direct into the 5-inch and 6-inch pots, as it saves labour, and stronger, sturdier plants are usually obtained.

Towards the end of May the first bunch of bloom will be showing, when the plants may be hardened off ready for their fruiting

quarters. If they can be got out well in advance of this first flowering, there is a chance of a good set being effected, whereas when raised earlier in the season and half starved, the first flowers drop prematurely, and a late crop is the consequence.

Blank spaces on walls between Peach and other trees are suitable positions for Tomatoes. It is even worth while to erect temporary fences for the purpose. High front walls of forcing and fruit houses may likewise be similarly utilized. If there are no borders, they can be formed on quite a hard bottom if need be, a foot in depth and

Fig. 179.—Neglected Plant—side-shoots not removed.

Fig. 180.—Result of timely removal of all superfluous growth.

width of good soil and a summer mulching of straw and manure sufficing.

No great amount of pains need be expended on the preparation of the soil, ordinary well-enriched garden soil being capable of supporting strong plants bearing heavy crops. If the plants are placed in the same sites every year, then not less than a good shovelful of fresh loam and solid manure ought to be given to each plant.

If protection of some kind can be afforded, the planting may be done during the third week in May; but, as a rule, when only a few are grown, little is gained and some risk is run by planting before the first week in June. Those to be trained against walls and fences should be planted 1 foot apart and kept confined to a single stem, but if plants are scarce they may be arranged 3 feet, or rather less, apart, and two side-growths be laid in addition to the central one.

No lateral shoots ought to be allowed to grow on either the single, central, or side growths (as shown in fig. 179), but all should be pinched out before they have a chance to either smother or rob the fruit of much sustenance. Keep the leading growths carefully fastened by nails and shreds to the walls and fences, or secured to wires or stakes, as the case may be, as they are very liable to break down if neglected. Stop the leaders beyond the third or fourth cluster of fruit.

When the fruits are approaching maturity, ripening will not be hastened by the complete removal of the leaves about them. Where the leaves cover the fruits they may be reduced somewhat in size, but the too common wholesale removal (as shown in fig. 181) is senseless in the extreme. All the defoliating advisable is shown in fig. 182. Much of the fruit should ripen during July, August, and September. What there are still hanging late in September should be cut before being injured by frosts. In the more moist localities ripening fruit are very apt to crack badly, and the remedy is to gather them when beginning to change

colour, and to finish the ripening in boxes or shallow heaps in a warm, dark room, or they may be covered up with paper, the colouring being more satisfactory and the foot-stalks fresher when ripened in the dark than is the case when the gathered fruit is exposed to sunlight. It is the smaller green fruits that should be utilized for making into pickles, the largest of those gathered in September colouring in due course.

Market-growers' Methods. — Market-growers who have gone intelligently to work have found the open-air crops of Tomatoes remarkably profitable, as much as £200 per acre net profit having been obtained in favourable years. Bad years there are occasionally, but the average is highly satisfactory in spite of these. The ground ought always to be well cultivated and manured, as for Potatoes. Hot soils may have a dressing of about 20 tons of half-decayed stable or farmyard manure, dug or ploughed in well in advance of planting-time. For moderately strong ground that has been previously cropped with Potatoes or Tomatoes, a dressing of a chemical manure is preferable to solid manure, the former giving the requisite support to the plants without promoting a too sappy, leafy growth. A chemical manure that has repeatedly done good service is made up as follows :—

Nitrate of soda	4	cwts. per acre.
Superphosphate of lime	8	,, ,,
Kainit	3	,, ,,
Sulphate of iron	½	cwt. ,,

The three last-named being somewhat slow to take effect, they should be thoroughly mixed with the top spit of soil well in advance of planting-time, while the quickly-dissolving, easily-lost nitrate of soda should be applied in the form of surface dressings, the first soon after the plants are put out, and another a month or six weeks later.

Where so many thousands of plants are required they must necessarily be prepared for putting out in quite small pots, also taking care not to raise them long in advance of planting-out time, or starvelings will be the result. Where spring frosts often occur as late as the third week in May, planting-out should not commence before that time ; but in the more favoured localities planting is frequently commenced about the

Fig. 181.—Common example of reckless defoliating,

Fig. 182.—Tomato Plant, partially defoliated.

middle of May, starting with well-hardened plants.

The most profitable arrangement is to dispose the plants 15 inches apart in rows 3 feet apart, confining them to single stems; but if the requisite number of plants cannot be raised, it is more economical to put them out 20 inches to 2 feet apart, and lay in a second growth from each, keeping both primary and secondary stems free of side-shoots. At the ends of the rows extra stout stakes (see fig. 183), and at intervals of 12 to 20 feet lighter stakes, should be driven in. These are for the purpose of straining and supporting one length of No. 16 gauge galvanized wire 3 feet from the ground.

Fig. 183.—Stout end Stake, with Tomato Plant, showing type usually planted by market-growers.

Fig. 184.—Bamboo Cane, with Tomato Plant turned out of 6-inch pot.

(See figs. 183 and 184.) Each plant should be supported by a 4-foot bamboo cane fastened at the top to the wire. This forms an admirable trellis for the plants, and may be used several years in succession if duly stored in the winter.

In all other respects the treatment of Tomatoes for market should be much the same as advised in the case of garden crops. It should be added that occasional waterings are needed by all open-air plants till such times as they are growing strongly, after which a mulching of short manure or leaf-soil will be all that is further necessary during the average summer. During exceptionally hot and dry seasons, plants in comparatively poor soil, and heavily cropped, are improved by an occasional good soaking of water or liquid manure.

Tomatoes are successfully grown in houses either with other plants or with Melons, Cucumbers, Grapes, or Peaches. They are even more successful when a house can be devoted entirely to themselves, as they are less liable to disease, and crop better in a dry, buoyant atmosphere, which does not suit the other plants named. High temperatures, accompanied by a moist atmosphere, have been the cause of many failures with Tomatoes. Even if the first flowers are followed by a good set of fruit, disease, when it has once effected a lodgment on the foliage, spreads so rapidly as to practically spoil the crop.

The various diseases to which the Tomato is liable—an intelligent grower living in the neighbourhood of Bath asserts he counted no less than ten forms of disease on his plants during one summer—makes its culture somewhat of a lottery at all times, and particularly so in mixed houses. It is therefore desirable to grow them in a house by themselves, or to locate them where they can be given more air than the other occupants of the house require.

Pot-grown Plants.—The earliest supplies of fruit can be had the most surely from plants in pots. Under good treatment

they succeed remarkably well, single plants in the 10-inch size being capable of producing 8 lbs. of fruit and upwards. They require closer attention than those planted out ; in particular they must have abundance of water and liquid manure. The soil in unplunged pots is at much the same temperature as the house, and in addition to this the roots also get the benefit of the aeration afforded by the porous pots.

If fruit is wanted early in the year, seed should be sown in September, and the seedlings be potted singly in 2½-inch pots, to plant weak leggy plants either in pots or borders. The fruiting-pots should be clean and well drained, the roughest of the compost going over the crocks.

Soil.—A mixture of two parts fibrous or good yellow loam to one of horse-droppings only partially decayed, with some charred soil and a sprinkling of soot and superphosphate of lime added, suits Tomatoes. It should be placed in the house where it is to be used long enough to get warmed prior to use, or the heap should have several red-hot bricks plunged in it. Press the soil

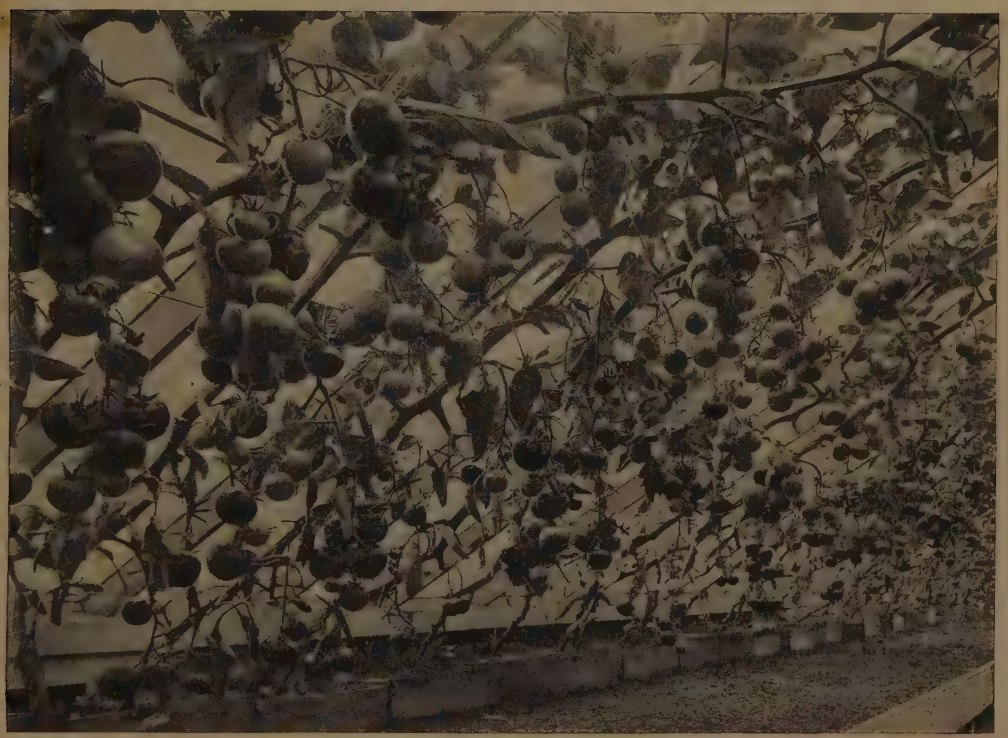

Fig. 185.—Tomatoes growing in boxes.

keeping them growing in a temperature of 55° by night to 60° and 65° by day, in a position near the roof glass. With this treatment good sturdy plants ought to be ready for the fruiting-pots by the middle of December. The 10-inch pot is recommended, but if preferred, a shift into 6-inch pots, and from these to the 10-inch before they become root-bound, will answer as well.

Plants thus treated should produce ripe fruit early in April, and to succeed these more seeds should be sown in January or early in February. The seedlings should be well treated from the first, as it does not pay firmly about the roots when potting, and leave four inches of space for subsequent top-dressings. If only a few plants are grown, these may well be arranged as thickly as they will stand on the staging or shelves along the front of a forcing-house, training them on wires fixed from 9 inches to 12 inches from the glass. They can also be grown at the ends of the house, but do not fruit so freely. Many more plants could be grown in a house, however, if the pots were arranged nearly as close as they will stand in cross rows 3 feet apart, and staked upright. Or they could be set on the back staging of lean-to houses and

trained upright, a row of plants also being arranged along the front and trained up the roof as far as they can be taken without detriment to the other plants.

In every case keep the plants to a single stem, by pinching out all side-shoots as they form, and training the leaders up till three or four good clusters of fruit are set on them, when they should be stopped and not allowed to extend any farther—unless the aim is to fruit them continuously as long as they pay for the trouble. If the leaves are so thick as to conceal the fruit, cut away a portion only of each leaf so as to expose the fruit. Directly the soil is well filled with roots, give a top-dressing of loam and horse-droppings, and do not be misled by the condition of this when watering, as the fresh soil may be quite moist, while that which is full of roots may be quite dry. Also give frequent doses of liquid manure, or of nitrate of soda and superphosphate in equal quantities, one ounce to each plant.

Temperature.—The size of the crop largely depends upon the maintenance of a dry, buoyant atmosphere, the fruit failing to set when the plants are grown under conditions suitable for Cucumbers. Allow enough fire-heat to keep up a temperature of about 55°, increasing to 60° and 65° in the daytime. A chink of top air should be left on when the nights are mild, and top air be given more freely in the daytime whenever this can be done without appreciably lowering the temperature.

Tomatoes thus treated are not likely to become diseased, and thus one hindrance to a good set will be avoided, while the flowers will open more naturally and pollen be more abundant than when more heat and moisture prevails. Nothing should be left to chance. In order to secure a good set, go over the plants, when in flower, about noon every day, and smartly tap the stems of the bunches with a padded stick; this frees and distributes the pollen, a portion of which lodges on the moist stigmas and effects fertilization. When grown strongly the central flower of each bunch is nearly always misshapen, having fasciated pistils, and if left, are followed by equally misshapen fruit. Such flowers should therefore be removed, and the rest of the bunch will then produce stronger flowers and finer fruit.

Successional Crops.—Early Tomatoes can be grown in boxes instead of pots, and in narrow ridges of soil arranged along the fronts of houses, rather less water being needed than when in pots. The great bulk of fruit grown for market is obtained from plants grown in houses with a clear border wholly devoted to them. This admits of full justice being done to the Tomatoes. It is useless to attempt growing them under Vines, the roots of which must have a fair share of the border, and they fare badly when they have to compete with hungry Tomatoes.

Market-growers use the ordinary garden or field soil over which new houses have been built. This is broken up or bastard trenched two spits deep, and, as a rule, it is quite rich enough to give the Tomatoes a good start, surfacings of special manures being watered in and mulchings of short manure serving to sustain the plants in a healthy, productive state till the end of the season. In the following year extra preparation of soil is needed, Tomatoes being great impoverishers of the soil. Trenching should be resorted to each winter, and if during the second operation the subsoil is freely manured, a complete reversal of the spits may be carried out during the third winter, thereby placing a fresh supply of fertile soil within easy distance of the roots. Some growers use the same soil year after year, first sterilising it by means of steam or the application of a special preparation, particulars of which will be found in the chapter on SOILS AND MANURES.

A light, non-retentive soil is greatly improved by a liberal dressing of pulverized clay or clayey soil, which ought to be well mixed with it. No one should start Tomato-growing over a heavy clayey soil, as to get this into the proper condition is usually an expensive undertaking. Mortar rubbish, burnt earth and ashes, sand, leaf-soil, and such like, when freely mixed with heavy soils, improve them considerably.

Manures.—Various fertilizers have been suggested for Tomatoes, but most authorities are agreed that a too free use of manures is liable to promote luxuriant, disease-inviting growth. American experts have proved that it pays better to use certain mixtures of chemicals at a fixed rate at planting-time than to distribute a similar quantity over a period of two or three months. Nitrate of soda and sulphate of ammonia act quickly, and if a full dressing is given at one time, a portion of it is liable to be washed away before the plants can avail themselves of it. Special mixtures for Tomatoes are to be obtained from vendors at reasonable prices, and if these are applied according to the directions given with them they are, as a rule, safe. For clayey, retentive soils sulphate of ammonia is better than nitrate of soda, and light dressings are

advised for soils not previously cropped with Tomatoes. Where animal manures have been applied rather freely, a surface-dressing of unslaked lime, at the rate of half a bushel to a square rod, would probably be sufficient.

Training.—As a rule Tomatoes produce the heaviest crops when trained up the roof near the glass; but a far greater number of plants can be found room for, and a much greater weight of fruit be had, by planting in rows across a house, and either providing each plant with a bamboo stake (see fig. 186), or a string secured to a peg in the ground and to the roof. It may be added that varieties of the Perfection type being preferred for exhibition purposes.

If the plants have been prepared as advised, and planted before they become root-bound, progress will be rapid from the first. The soil about the roots must be made quite firm. The plants when young must not suffer for want of water. Later on they will require copious supplies, which should be given in the mornings of bright days with a view to getting the house dry before night. It is a great mistake to delay removing the side-shoots until a knife has to be used (see fig. 179).

Fig. 186.—Tomato plants with bamboo stakes.

bamboos are best in the long run, though they may seem a little expensive at the outset. Crowding the plants is a great mistake. Repeated trials have proved that a distance of not less than 3 feet should separate the rows, the plants in the rows being 12 inches apart. Given this space there will be no necessity to remove many leaves, but they usually require to be reduced to about one-half their natural size, according as they begin to press against each other.

For the later crops the smooth round varieties are most suitable, those of a medium size, such as Bide's Favourite, Ailsa Craig, Sunrise and Princess of Wales, finding most favour with market-growers, the larger

As the days lengthen, and it is possible to ventilate more freely, a good set of fruit is easily effected; but no risks should be run, and the padded stick must be used daily as long as the plants are in flower. If handsome fruit are required, on no account neglect the early removal of the central ugly flower, and if the other flowers are thinned out the rest will be stronger, and if duly fertilized will develop finer fruit. If the flowers have not been thinned, then the number of fruit must be reduced, that is, if good examples are wanted. Topping the leading growths beyond the second or third cluster of fruit may have the effect of slightly increasing size, but, as a rule, no topping

need be practised till the tops of the stakes or the roof is reached. Sometimes the plants next to the sides or fronts of houses are not topped when the glass is reached, but are allowed to extend up the roof, when they continue to fruit till later in the season, those underneath being cut out as fast as they are cleared of fruit. There should be enough heat in the hot-water pipes to maintain a temperature of 55° during the night; a slight heat in the pipes during the day, accompanied by top-air, more or less according to external conditions, serves to keep the house dry and the air buoyant. Never delay opening the top ventilators till a high temperature, accompanied by a great increase in the humidity of the atmosphere, is reached, nor close them early enough to bring about the same undesirable conditions, as this invariably leads to a rapid spread of disease.

Autumn and Winter Crops

The demand for Tomatoes is greatest from May to September, but it is considerable at all times of the year. Private gardeners will gain credit with their employers if they grow as many as possible for late autumn and winter consumption. The secret of success lies in realizing the fact that Tomatoes fail to produce perfect flowers late in the year; but this difficulty can be surmounted by starting the plants soon enough to flower and set the fruit before dull, sunless weather sets in, these ripening in succession throughout the winter. The simplest plan would be to grow enough plants in pots in the open, and when these were well set with fruit, or say about the middle of September, to house the whole of them. A mixture of sulphate of copper and lime in a powdered state, and applied through a dredger or other distributor, would check the spread of disease without greatly injuring the flowers. For these late crops, whether they are to be wholly or only partially grown under glass, it is a mistake to start later than May for plants to be prepared in the open, or the early part of June for any to be grown wholly under glass. A few ripe fruit may be had from these plants before they are wanted, but the bulk will ripen more slowly and keep a long time after they are ripe, whereas later-raised plants will not only produce lighter crops, but will also very probably become badly diseased before much of the fruit has ripened.

When pot-plants are to be prepared in the open, use the 10-inch size with one plant in each, and arrange them 14 inches apart in rows about 3 feet apart on a hard bottom placing a bamboo or other stake 4 feet high to each. Give a rich top-dressing after the soil is well filled with roots, and keep well

Fig. 187.—Tomato—Perfection.

supplied with water and liquid manure. No side-shoots should be allowed to form, and the one leading growth must be secured to the stake.

Late in the summer some of the lower older leaves should be reduced to about half their size, and when the plants are transferred to the house, they may be stood rather more closely together than formerly, or even between or among older Tomato plants that have been cleared of their lower clusters of fruit and leaves. Those planted under glass early in July may either be treated similarly to earlier batches, planting them in rows across the house, or the roof may be covered with them, the extension system answering well for these late crops. Plants that have already borne good crops are sometimes roughly pruned, and a number of side-shoots laid in from them in an irregular fashion. These shoots should not be allowed to form any side-shoots, but ought to be trained thinly, or about 12 inches apart, clusters of fruit forming on them to their entire length. The greater portion of old plants from the borders or ridges should be removed; a top-dressing with some rich compost and applications of liquid manure are good for

these old plants, and the young ones ought not to be starved.

Late Tomatoes are also grown in boxes on the back shelves of vineries, and trained down the roof; but these have to be cut and ripened in stronger heat before the house is set widely open, so as to give the Vines their needed rest. If the pot and other late-cropping plants are kept in a temperature ranging from 55° by night to 60° to 65° in the day, they will not only give a long succession of well-ripened fruit, but they will push out side-shoots freely, which, if duly thinned, will each give a cluster of fruit in the spring before it is possible to have any from plants raised in January.

Tomatoes in Pits and Frames.—More often than not Tomatoes in pits or frames become badly diseased before a profitable crop can he had from them; or if they escape disease they fail to set. Those in frames are apt to grow too rank, and the same thing happens in pits unless the roots are confined to either pots, boxes, or narrow ridges of soil. Various contrivances are needed to raise the haulm clear of the soil. Instead of attempting to grow Tomatoes under such disadvantageous conditions, it would be better to devote a house to them in summer, relegating the ordinary occupants largely to frames or outside.

Frame culture answers when the plants are not grown too strongly nor crowded. They may be planted in frames in succession to early Potatoes, with a view to giving them a good start prior to removing the lights and exposing the plants to all weathers. Two rows of plants may be disposed from the front to the back of each light. When established and requiring to be staked, remove the light and place a 4-foot stake to each plant. Plants thus started should be well ahead of those in the open air, and produce a heavy crop of ripe fruit fairly early.

Diseases.—The well-known Potato disease (*Phytophthora infestans*) affects Tomatoes also, open-air plants with their crops succumbing to it in a wholesale manner whenever Potatoes are badly affected. During a hot, dry summer very little is seen of this disease. In a wet season, if the plants cannot be kept dry by a temporary protection, the only other remedy is either occasional sprayings with Bordeaux mixture, as recommended for Potatoes, or frequently dusting with "Anti-Blight" powder, a mixture of newly-slaked lime and sulphate of copper. Both remedies are apt to seriously check the growth of the plants.

Tomato Leaf Rust (*Cladosporium fulvum*) occurs principally on plants grown under glass, and in some seasons is most destructive. At the outset a few leaves only may

Fig. 188.—Tomato Leaf-Rust (*Cladosporium fulvum*).

be affected, but if neglected the disease spreads rapidly from one house to another. The under side of the leaves is attacked, patches of brown mildew-like fungus destroying the cuticle and tissues of the leaves. A warm, moist, stagnant atmosphere favours the spread of this disease; and the soft leaves of overfed plants are the first to succumb, soon being left without a healthy leaf on them, the fruit also being spoilt.

The best preventive is to grow sturdy plants in a warm, dry, airy condition. A sharp lookout should be kept for any symptoms of disease, removing and burning any diseased leaves.

Bordeaux mixture at half strength if applied at an early stage checks the disease. But prevention is better than cure. All diseased plants should be pulled up and burnt.

Another course of treatment which has been known to succeed is that of making the hot-water pipes unbearably hot, running up the temperature to 110° or 120°, repeating

this every second day for a week, with the result that all the disease germs are destroyed. This should be done in the daytime. This disease is rarely troublesome in well-heated houses in which Tomatoes are grown for an early crop.

Black Stripe or Black Rot (*Macrosporium Lycopersici*) is another destructive fungus disease to which Tomatoes are subject. A good start may be made with the plants, and a crop of fruit set on them, before the disease manifests itself by a shrinkage and discoloration of the stem in the form of black stripes. Blotches also appear on the leaves, and on the fruit, which become pitted owing to the collapse of the tissues.

There is no known cure for this disease. Preventive measures are therefore imperative. The very seeds are liable to carry contagion with them, and ought to be dis-

Fig. 189.—Tomato—Best of All.

infected before sowing. This may be done by coating them with flowers of sulphur, or by soaking them in a weak solution of Condy's Fluid. The soil used should be limed. Affected plants ought to be drawn and burnt, and lime applied to the soil they came out of.

Sleepy Disease (*Fusarium Lycopersici*). Plants affected by this disease may apparently be in good health and in a fair way to produce extra heavy crops on one day, and the next the leaves all droop and change colour, never again to recover. Diseased plants should therefore be at once rooted up and burnt, and the soil removed.

Root-gall or Eel-worm (*Heterodera radicicola*) is a minute worm, not visible to the naked eye. It causes gall-like swellings on the roots of Tomatoes and other plants, being very abundant in some soils. For treatment see chapter on Insect Pests. The only remedy against it is to sterilize the soil before use. There is no known cure.

Wire-worms are destructive to Tomato plants planted in newly-broken-up ground, eating their way into and up through the centre of the stems, flagging foliage being the first signs of their presence. At this stage there is no remedy, quite large plants having in many instances to be pulled up (see chapter on Insect Pests).

The *Insect Pests* that affect the Tomato are not numerous. Treatment for Green-fly, Red Spider, and Snowy Fly will be found in the chapter devoted to Insect Pests.

Selection of Twenty-four Varieties.

Ailsa Craig.—The favourite with market gardeners for glass-house cultivation. Fruit of medium size, round as a billiard ball, bright red, tough skinned, rarely cracks, and is a great cropper under forcing treatment. Out of doors it should be grown against a south wall.

Best of All (fig. 189).—Sets freely and is an immense cropper in the open, producing heavy bunches of fruit at short intervals all over the plant. Excellent in form, of good size, solid; colour deep-scarlet.

Bide's Recruit.—One of the best for indoor culture, a great bearer of shapely, rich red, well-flavoured fruit. Has a great reputation with market gardeners.

Buck's Tresco.—A marvellous cropper which has become a general favourite, among amateurs especially.

Champion.—Sturdy growing and free setting both under glass and in the open. Fruit of medium size, round, smooth, deep-scarlet; five to nine in a cluster. Ripens in the open first week in August. One of the best for all purposes.

Duke of York.—Strong grower, but not free in setting. Fruit large, flattish-round, smooth, scarlet; averaging three to a cluster; of good form and fair flavour.

Dwarf Gem.—Plant seldom exceeds 2½ feet in height; foliage large, dark, curled, the plant presenting a very striking appearance. The pale-yellow fruits are perfect in form, and borne in immense clusters.

Frogmore Selected.—A strong grower and heavy cropper. Fruit medium to large, deep, round, slightly corrugated, handsome, scarlet; averaging six to a cluster; solid, good flavour. Good both under glass and in the open.

Golden Jubilee.—Plant robust and free bearing under glass, but no good in the open. Fruit large, round, deep-yellow suffused with red, smooth, handsome; averaging five to a cluster; solid, fine flavour.

GOLDEN NUGGET.—A moderately strong grower, free setting and distinctly ornamental both under glass and in the open. Fruit small, roundish-oval, smooth, bright-yellow; averaging eight to a cluster; solid, fine flavour.

GOLDEN PERFECTION.—A very fine yellow variety of perfect shape and good flavour.

Fig. 190.—Tomato—Golden Sunrise.

GOLDEN SUNRISE (fig. 190).—Handsome medium-sized fruits of fine flavour, slightly more acid than red varieties. Heavy cropper.

HAM GREEN FAVOURITE.—Moderately strong growing and more reliable than Chemin Rouge, which it resembles. Fruit large, flattish-round, smooth, deep-scarlet; averaging seven to a cluster; solid, good flavour. A heavy cropper inside and outside.

HOLMES' SUPREME.—Of sturdy habit with rather finely-cut leaves; setting freely under glass and in the open. Fruit medium, round, smooth, bright-red; averaging nine to a cluster; very good flavour. A heavy cropper inside and outside. Ripens outside August 4th.

PEACHBLOW.—Robust in constitution, sets freely, and carries an extraordinary crop. Plant distinctly decorative, with numerous bunches of elegant fruit having all the charm of a handsome Peach; flavour good.

PERFECTION (fig. 187).—A very handsome red variety. A free cropper, and one of the very best for exhibition purposes.

PRINCESS OF WALES.—Free growth. Fruit of medium size, smooth, round, bright-red in colour, and of excellent quality. A heavy cropper, and one of the best for all purposes.

REGINA.—A grand tomato, especially for cultivation under glass.

SUNBEAM.—A moderately strong grower and a free bearer both under glass and in the open. Fruit medium to small, oval, smooth, handsome, bright-yellow; averaging nine to a cluster; solid, excellent flavour. A good dessert variety.

SUNRISE.—Unquestionably the finest Tomato for general use yet raised.

SUTTON'S DESSERT.—A moderately strong grower and a free setter under glass, somewhat shy in the open. Fruit small, round, smooth, handsome, scarlet; averaging eight to a cluster; solid, excellent flavour.

THE COMET.—Not a strong grower, but very free bearing. Fruit medium, round, smooth, of good form, deep-scarlet; averaging six to a cluster; solid, good flavour. One of the best for open-air culture, commencing to ripen first week in August.

THE CROPPER.—A strong grower and heavy cropper. Fruit medium, deep, round, smooth, good form, bright-scarlet; averaging five to a cluster; solid, good flavour. Ripens outside early in August, but the fruit is liable to crack.

WINTER BEAUTY.—A sturdy grower and very free setter. Fruit large, round, smooth, occasionally slightly ribbed, bright-scarlet; solid, excellent flavour. Good for autumn sowing; crops heavily in the open. Still the finest winter Tomato.

YOUNG'S ECLIPSE.—A moderately strong grower and a free bearer inside and outside. Fruit medium, round, smooth, scarlet; averaging five to a cluster; solid, of good flavour. Ripens in the open middle of August.

TREE PRIMROSE (*Œnothera biennis*).—A hardy biennial, native of Virginia, but naturalized in many parts of Europe. It is cultivated in France for its long fusiform roots, which are cooked in various ways. The following details respecting the method in which it is cultivated and used in that country are translated from the *Bon Jardinier*: "It is sown thinly broadcast in April on well-dug ground, and when the young plants have made a few leaves they are planted in quincunx order, at from 12 to 20 inches apart, in ground manured the previous autumn. During the summer the ground is kept clean, and the plants watered when necessary; in the autumn the roots are taken up, deprived of all the leaves, with the exception of the heart-leaves, and stored in a cellar, or they are left in the ground and taken up as required, for the plant is perfectly hardy. The roots are eaten boiled, either cut into slices and put in salad, or served up with white sauce like the roots of Salsafy. They are also put into soups. This vegetable is recommended for weak stomachs, being easy of digestion, and nourishing at the same time. It is not used after Easter, as the roots by that time become hard and woody."

TROPAEOLUM TUBEROSUM (see fig. 115).—A perennial, native of Peru. It produces an abundance of pretty yellow and red tubers, the size of small Pears, the taste of which is not, however, very agreeable. On this account a particular mode of preparation is adopted in Bolivia, where,

according to M. Decaisne, they are treated in the following manner :

The tubers require to be prepared before they become edible. Indeed, when they were cooked like Potatoes, immediately after being taken up, their taste was very disagreeable. But in Bolivia, where they have become, if not a common vegetable, at least one which is quite edible, the tubers are frozen after they have been cooked, and are eaten when frozen. In this state M. Weddell affirms that they constitute an agreeable dish, and that scarcely a day passes at La Paz without two lines of dealers being engaged in selling the ' Ysano,' which they protect from the action of the sun by enveloping it in a woollen cloth and straw.

The ladies of La Paz are all very fond of the Ysano ; and in the season of the *taïachas* large quantities are sopped in molasses, and taken as refreshment during the heat of the day.

This plant may be propagated by pieces of the tubers in the same manner as Potatoes, an eye being preserved in each piece. The sets should be planted in April, about 4 feet apart, in light rich soil. The stems may either be allowed to trail along the ground, or pea-sticks may be placed for their support ; in dry soils and seasons the former method should be adopted ; in those which are moist, the latter. The tubers are taken up in October or November, when the leaves begin to decay, and stored in sand.

TRUFFLE (*Tuber æstivum*) (fig. 191).—A kind of Puff-ball, nearly spherical in shape, which has been known to attain a weight of 3 or 4 lbs., and measure 4 inches in diameter. The surface is rough, warty, and black. The flesh is grayish or white when young, black veined with white when old. The smell is powerful, but by no means unpleasant. It grows from 2 to 10 inches under the surface of the ground, and the spots where it is to be found are discovered by means of dogs trained for the purpose. It is abundant in some parts of Britain, particularly in Wiltshire, Kent, and Hampshire, but it never occurs in any but calcareous soils, where it grows under the shade of trees, generally the Oak and Beech. In warm, moist years it may be found throughout the year, but most abundantly from August to October.

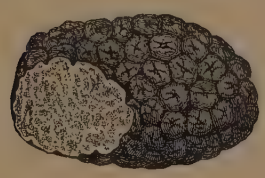

Fig. 191.—Truffle.

Truffles constitute a much-esteemed luxury, seldom indulged in by any but the rich. They are used in sauces, gravies, and in a great variety of dishes ; indeed it is an axiom with first-rate French cooks that the Truffle improves all that it touches. There is, however, no doubt that they are injurious to health when eaten in large quantities.

TURNIP (*Brassica Rapa*).—A hardy biennial, native of Europe, including Britain. It has been cultivated for its roots from time immemorial, and the leaves are also frequently used as Greens, or sometimes blanched as a substitute for Sea-Kale.

The French Turnip, a fleshy-rooted variety of *Brassica Napus*, which is sweeter and of better flavour than the Common Turnip, but inferior to it in size, is likewise cultivated for the same purposes ; and the Swedish Turnip (*Brassica campestris Rutabaga*) is sometimes grown, on account of its extreme hardiness, in gardens in very cold situations where other sorts are liable to be injured by frost.

Soil and Manure.—The garden Turnip succeeds best in light loamy soils, containing a large proportion of sand. Stiff retentive soils, on the contrary, are ill adapted for the growth of good crops of well-flavoured roots, and on such also early crops are more apt to run to seed. In light dry soils well-decomposing farmyard dung is one of the best applications that can be made, as it not only affords nourishment but moisture to start the young plants into the rough leaf. For heavy land, littery dung, not much decomposed, may be advantageously employed. Bone-dust, superphosphate of lime, or guano, applied either separately or together with farmyard manure, exercise a highly beneficial effect on the crop, especially in old garden soils containing an excess of organic matter, forcing the plants into the rough leaf, and encouraging the development of the roots.

Garden Turnips are sometimes sown broadcast in borders, and as they are not required to be large, this mode answers very well in light soils. Where the soil, however, is more tenacious, it is a good plan to draw shallow drills with a hoe at about 15 inches apart, which may be watered with guano-water, and the seeds be sown as regularly as possible, then slightly covered with fine soil.

If young Turnips are required early, seeds of the Early Milan may be sown in a warm border in the end of January or in February, and protected. A larger sowing should be

made in March, two more in April, and one in May. Two or three varieties should be employed, for it often happens that one sort succeeds whilst another fails. In northern and cold districts the principal autumn and winter crops should be sown in the last week of June, and in southern parts of the kingdom in the first fortnight of July. A small sowing may be made in the first or second week of August, and even in the last week of that month, for supplying young Turnips occasionally in winter, and for standing later in spring than the main crop. In most situations a sowing once a month, from March to July inclusive, will be sufficient, especially if, from experience, the most suitable varieties can be chosen.

After sowing, attention should be directed to the protection of the plants from the ravages of fly, and this may be done by a layer of short mown grass half an inch thick; this also prevents attacks from the birds. In some states of the weather this is very difficult, and the whole sowing may either be destroyed, or the plants be so crippled that they never recover. Just before the plants make their appearance the ground should be well moistened if the weather is dry, and dusted over with lime. For remedies see chapter on Insect Pests.

A moist season, or one in which warm, cloudy weather prevails, is most suitable for Turnips. In continued dry weather the growth of the plants is checked, and although genial weather should ensue, roots are never so tender and succulent as if growth had taken place at a uniform rate. Watering should therefore be attended to in dry weather. Cold spring water must not, however, be used, as such would tend to check the growth, in hot weather more especially. The soil, by means of moistening and stirring, should be kept as loose as possible, and, as a matter of course, free of weeds. Partial thinning should be commenced as soon as the plants are fairly above-ground, or at all events as soon as they have acquired their first rough leaves. The distance left between the plants must be regulated according to the size of the variety. In rows or drills the small sorts may be left at 4 inches apart, and the larger at 5 or 6 inches. In broadcast sowings 6 inches may be allowed each way for summer crops, and 8 inches for those intended to stand the winter.

Storing the Roots.—Turnips for summer and autumn use are, of course, drawn as they are required—the largest roots being taken first. With respect to the winter supply, the greater portion may generally be left in the ground, to be taken up as wanted; but a small quantity should be taken up, topped, tailed, but not very closely, and stored in sand for use in frosty weather. In cold situations, if the more tender sorts are grown, it is advisable to take up the whole crop, and store it in ridges

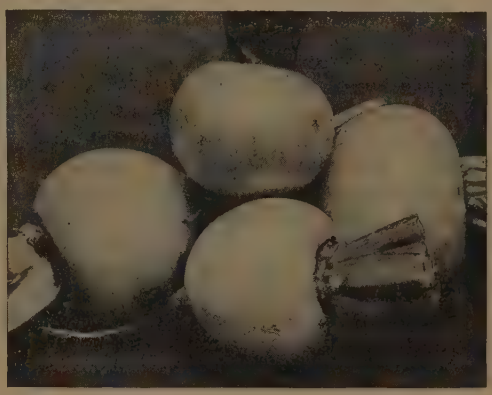

Fig. 192.—Turnip—Early Snowball.

like Potatoes, and the same precautions taken against frost and damp.

Forcing.—Hard forcing invariably ends in failure; but if early Turnips are particularly required they can be had in May with the aid of a very mild hot-bed and frame. If the latter is somewhat deep, or such as are used for Potatoes, partially fill with short manure, making it quite solid, and on this place 6 inches of good loamy soil. Sow seed of Early Milan thinly broadcast, and cover with fine soil. As soon as the seedlings

Fig. 193.—Turnip—Early White Dutch.

are up, commence ventilating, giving air rather freely on mild days, and in small quantities when it is cold, closing somewhat early and covering with mats every night. Thin out lightly at first, leaving the plants about 4 inches apart each way, and then if the more forward are drawn for use when the roots are about 2 inches in diameter, the

rest will, if properly attended to, give a good succession. Turnips may also be forwarded considerably without bottom heat in shallow frames on a warm border.

To save Seeds.—It is rather a difficult matter to obtain the seeds of Turnips true in gardens, on account of the tendency which all plants of the Brassica tribe have to cross with one another. For this reason no other plant of that genus should be allowed to flower at the same time in the neighbourhood of the sort the seed of which is to be saved. Only the best-formed plants ought to be selected for bearing seeds, and they should be taken up in autumn, and planted 2 feet apart in an open situation. When the seeds are perfectly ripe they may be beaten out, and after having been

Fig. 194.—Finger-and-toe Disease in Turnips.

well dried, hung up in a canvas bag in a cool, dry, airy place. They retain their germinative power for four or five years, and sometimes longer.

Turnips are liable to be attacked by *anbury*, or *finger-and-toe* disease (see fig. 194). For particulars see under Fungus Diseases.

The principal garden varieties are :

Chirk Castle Black Stone.—A strap-leaved sort with ball-like black-skinned roots, the flesh white and tender, mild in flavour. Useful in winter.

Criterion.—A distinct type of garden Turnip, especially suited for early use, and also as a general crop. It is a strap-leaved variety, having a red top ; flesh pure and white, sweet and mild in flavour.

Early Six-weeks.—Globular, and growing chiefly above-ground. Skin greenish-white ; flesh white, tender, and of good flavour. Very early, and only adapted for use in a young state in summer and autumn.

Early Snowball (fig. 192).—The earliest and most perfectly formed round white Turnip for garden use. Flesh snowy-white, solid, and mild in flavour. Unequalled for the exhibition table.

Early White Dutch (fig. 193).—Roundish-oblate or flattened, skin white ; flesh white and very tender ; must be used in a young state. From 2 to 2½ inches in diameter is a good size for use.

Extra Early Milan.—A remarkably early strap-leaved variety, remaining a long time fit for use. The roots are white, with purple top, round, flattened, and solid, with a very slender tap-root ; flesh pure white, sweet, crisp, and of excellent quality. There is also a pure white-skinned form of it.

Fig. 195.—Turnip—Teltow.

Matchless.—A valuable companion to Criterion, resembling that variety in shape, but with a green instead of a red top. A great acquisition to the list of garden Turnips. The roots go such a depth in the soil that it can stand the dry weather.

Orange Jelly (Golden Ball).—Of a handsome round form, with a small top. The skin is pale-orange, the flesh yellow, juicy, sweet, and tender. It has very little fibre, so that when boiled it almost acquires the consistence of a jelly.

Red American Stone.—Small, oblate, growing chiefly above-ground. Skin violet where exposed to the light, white elsewhere ; flesh white and tender, but not so sweet as that of many other sorts.

Red Globe (Veitch).—Appreciated for its form, colour, and flavour. Roots globular, and the colour of the top shows to advantage on the exhibition stage. Flesh white and of the finest quality. Does well on heavy soils, and is one of the best for sowing in July or August.

Scarlet Perfection.—For its fine colour, striking form, and high quality this Turnip

deserves to be widely grown. In shape it is a counterpart of Yellow Perfection, but the skin is of a crimson-scarlet colour, and on the exhibition table it presents a most attractive appearance. Flesh white, close; flavour sweet.

Scotch Yellow.—Roundish, growing about half above-ground. Skin yellow; flesh yellow, firm, and very sweet. An exceedingly hardy sort, standing a severe winter better than any other garden variety. In the south it should be sown for winter use about the middle of July, and in the north in the beginning of that month.

Fig. 196.—Turnip—Yellow Finland.

Teltow (fig. 195).—Very small, with a tapering root, and a top not larger than that of a Radish. The flesh is firm, very hot, but the rind is more especially so; this part, however, is not peeled off, as in it the piquant flavour is principally contained. It is employed in ragouts, and for seasoning in various ways. It should be sown in light sandy soil. In the neighbourhood of Teltow in Brandenburg it is sown in April, and again in August; but for the second sowing in this country July is late enough.

White Gem.—Good for forcing or for the early border. It is oblong in shape, remarkably quick in growth, and of delicious flavour. It forces with greater success, and is also valuable for sowing on an early border in the open for first supplies.

White Stone.—Round, somewhat flattened, larger than Early White Dutch. Skin white, tinged with green; flesh white, of fine quality. It is well adapted for late sowings, and is soon fit for use; sown in spring it is apt to run quickly to seed.

Yellow Finland (fig. 196).—Small, round above, concave below, with a very small tap-root. Top small. Skin smooth and yellow; flesh yellow and very sweet. An excellent sort, somewhat earlier than the Yellow Malta, to which it bears considerable resemblance. It should be sown in June and July.

Yellow Malta.—About 2 inches in diameter, round, flattened above, and rather concave below, with a small tap-root proceeding from the centre of the hollow. Flesh yellow and tender. An excellent sort.

Yellow Perfection.—Delicious in flavour, shape rather flat, with short top; colour golden-yellow; certainly one of the handsomest. Matures quickly.

VEGETABLE MARROW (*Cucurbito Pepo*) (fig. 197).—The true Vegetable Marrow has long slender trailing stems, wavy, toothed leaves, sometimes blotched with gray and rough to the touch; the fruits vary in size and shape, but the ordinary size is about 9 inches in length and of the shape shown in the figure. They are most palatable when cooked before they have attained full size. Indeed, it is only when the fruits are in this state that the term "Vegetable Marrow" may be said to be quite appropriate. Not only are the small fruits the most delicately flavoured but their close removal serves to keep the plants in a vigorous productive state, whereas when most of the fruits that form early in the season are allowed to attain a great size, and partially mature seeds, this so exhausts the plants as to prevent them from cropping continuously. During a hot and dry summer Vegetable Marrows are among the few green vegetables available for the London and other markets in quantity, and in this case moderately large fruit pay best.

Culture.—Their cultural requirements are of the simplest description. It is quite a mistake to imagine that a great heap of decaying manure is absolutely necessary for them. On the contrary, they can be successfully grown without any more manure than has been dug into the ground for early Potatoes, and they may be either planted among early maturing short-topped varieties of the latter, or, in the southern counties, be even sown among them from the middle to the end of May, with every prospect of their doing well. Single plants from pots on small hillocks 4 feet apart each way, distributed through the Potato patch, and allowed to spread and crop as they will, give excellent results.

The market-grower's plan ought to commend itself to private gardeners. It is as follows: Mark out trenches, in a sunny spot, 4 feet wide with 4 feet intervals; throw out the best of the top spit, and wheel in from 12 inches to 18 inches of warm or only half-decayed manure. Make this firm, and bank over with the soil thrown out, a depth of 9 inches being required. Sow the seeds late in April; and place in gentle heat with a view to having plants ready for the beds from the middle to the end of May, according

to whether protection can be afforded or not. If it is not possible to raise the requisite number of plants under glass, sow the seeds

Fig. 197.—Vegetable Marrows—White.

in the beds where plants are wanted, the third or last week in May being early enough to do this. The plants may be put out at a distance of 5 feet apart through the centre of the bed, after all danger from frosts is thought past. If hand-lights or bell-glasses can be afforded, for giving the plants a good start, by all means use them, gradually withdrawing them when the plants need more room. A variety of other substitutes, including old baskets, market-sieves, benders, and oiled paper, or even branches of evergreens, are better than no protection at all. In dry weather give water occasionally, but after they are well established it is not often water is afforded. Where the wind is liable to twist the trailing stems about, peg down the leading growths with strong wooden pegs, but there will be little if anything gained by stopping any of the growths. Plants grown under these conditions will continue bearing freely till severe frosts intervene, and it frequently pays to roughly protect from the earliest of these.

Vegetable Marrows are suitable for training over summer arbours, wall-trellises, fences, and such like. In these instances narrow trenches should be opened and otherwise prepared, as advised for the beds in the open.

Forcing and Fruiting on Beds.—Vegetable Marrows may be grown on a hot-bed in a heated brick pit after the manner of Cucumbers, or in houses, as Melons are grown, less heat, however, being desirable. They also succeed in pots of the larger sizes and in boxes. In any case a rich loamy compost, in a coarse state, is desirable, and abundance of water and liquid manure must also be supplied. A temperature ranging from 55° to 60° by night with from 5° to 10° increase in the daytime is quite high enough, and the syringe should be freely used in the mornings of clear days and again on closing the house. Do not stop the plants, but remove side shoots till the roof trellis is reached, afterwards extending the leader straight up the roof and secure as many fruit as possible from the side shoots. It is of the greatest importance that every female flower be fertilized, or otherwise the embryo fruit at the base will turn yellow and drop off. The flowers only remain open a few hours, and it is frequently necessary to fertilize them before 9 a.m.

A few plants could be forwarded in frames and hand-lights set on large beds formed with anything that will generate heat. A mass of stable manure, vegetable refuse,

Fig. 198.—Vegetable Marrow—Striped.

leaves, road trimmings, sweepings, and such like should be collected, thrown in a heap to heat, and be then turned and framed out in a square heap, 30 inches to 3 feet deep. On this shallow frames or hand-lights may be set, and hillocks of loamy soil placed in them. All this may be done sufficiently early to admit of plants being put out early in May. In addition to covering with glazed lights, mats or other protection should be afforded every night. Do not stop till the main growths are near the outsides of the frames, and the side shoots from these will give early fruit. Early in June commence blocking up the frames with a view to hardening off and allowing the plants to spread of their own free-will. In this manner early as well as continuous crops can be had, and a fine heap of manure be available for the garden during the following winter.

LONG WHITE AND LONG GREEN.—Excellent varieties, of superior flavour.

MOORE'S CREAM.—Oval, cream coloured, fruit very prolific.

PEN-Y-BYD. — Very prolific, creamy white, globular in shape.

PERFECTION.—A dark-green form of the well-known variety Pen-y-byd.

TABLE DAINTY.—Distinct in form, exceedingly prolific and early.

TENDER AND TRUE.—A bush variety, should be grown where little room is available.

WOOD SORREL (*Oxalis Acetosella*).—A hardy perennial, native of Britain, where it grows wild in woods. The leaves are occasionally used in salads, to which they are by many considered to be a grateful addition. In common with other plants of the same natural order, they contain a considerable amount of oxalic acid. This plant is seldom cultivated in gardens; but if required, a few plants may be transplanted in spring from the places where they naturally grow, into a moist shady border, the soil of which should be mixed with leaf-mould. By cutting over the plants in April or May, before they come into flower, a fresh growth of young leaves will be induced, and the trouble arising from seed being shed will be prevented.

WORMWOOD (*Artemisia*) (fig. 199).—Three species are cultivated: Common (*A. Absinthium*), Roman (*A. pontica*), Sea Wormwood (*A. maritima*).

These are all hardy perennials, natives of Europe. They are aromatic and intensely bitter. An infusion of the leaves and tops

Fig. 199.—Wormwood (*Artemisia Absinthium*).

is used as a vermifuge, tonic, and stomachic; and the leaves are found to be beneficial to poultry. The second sort, not being so nauseous as the others, is the one generally preferred.

Wormwood grows well in any soil, but is most aromatic when planted in a poor and rather dry soil, with a warm aspect. The common sort may easily be raised from seed sown in spring, but both this and the other kinds are generally propagated by dividing the plants in spring, or by cuttings. They may be planted 1 foot apart in rows 15 inches asunder, and will stand for many years in the same place, no other culture being required than to hoe the ground occasionally. Some shoots may be cut when coming into flower, and dried for winter use.

COLLECTING, STORING, AND PACKING VEGETABLES

Large quantities of vegetables are spoilt either by collecting them too early or too late, by faulty storing, or by bad packing. There is a certain stage in the life of every vegetable when it is at its best for human consumption. If this period is anticipated the best qualities cannot be brought out by those cooking or preparing them for use, while on the other hand the period of collecting may be too long deferred, and coarseness, or lack of tenderness, has to be obviated by means not conducive to their wholesomeness when cooked. It is very certain that vegetables cannot well be too fresh, and that is where home-grown produce has, or ought to have, a decided advantage over any purchased. At times it becomes imperative to collect vegetables before they are really required for use, or otherwise they will spoil where grown, whereas, when stored for a long or short period, as the case may be, they can be retarded in some instances and protected from bad weather in others.

Too much care cannot be taken in selecting, grading, bunching, and packing vegetables, whether they are to be marketed or sent to their owner's town or seaside house. Directions for the most important vegetables in regard to the time to collect them, either for immediate consumption, or for storing or for packing them to be sent a long journey, are given here :—

ARTICHOKE.—The Globe section, grown exclusively for their flower-heads, should not have these cut for use before the scales are fully unfolded. It would be a mistake to cut them when no more than half-grown, or to leave them till they are opening in the centre. As soon as a few of the outer scales open, cut the heads with a short length of stalk attached, and if not wanted for use the same day stand them in a pan of water in a cool dark place. As severe frost damages them, they require protection of some kind, if not cut and stored as advised.

Globe Artichokes bruise rather easily; it is well, therefore, to take some pains in packing them. If laid flat and close in fresh long grass, fixing them tightly in the hamper or box with more of the same or some kind of soft green vegetable, they will travel safely. The same pains should be taken in packing for market.

Stachys tuberifera, commonly called Chinese Artichoke, form small spiral tubers which are available for use during autumn and winter. If the tubers are exposed to the atmosphere for a few days they quickly shrivel and become valueless. They ought, then, to be left in the ground, protected with strawy litter, and in the spring what are still under should be lifted and at once stored in sand. Enclosed in paper bags they can be sent any distance in ordinary mixed vegetable hampers.

ARTICHOKE, JERUSALEM.—See SUN ROOT.

ASPARAGUS.—Shoots of Asparagus cannot well be too long, always providing the points are not unduly developed. It is also desirable that a good portion of the stalks should be blanched, not necessarily because this is a sign of good quality, but rather because they look better. The greater part of the shoots should be eatable and not blanched and stringy. French Asparagus is very large and blanched to nearly its full length by high culture and by heavily mounding over the plants with light soil. Too often English-grown plants are not planted deep enough, and the produce

would be greatly improved if the shoots had to come through at least 3 inches of light soil. The same remark applies also to forced Asparagus. The shoots should be carefully cut, washed, graded, and bunched. If the various sizes are mixed indiscriminately the whole cutting would be considered second-rate, both by buyers and cooks, and if cooked in a similar haphazard fashion some of the shoots would be overdone and others probably not sufficiently boiled. It is a good plan to make three sizes—extra-fine, medium, and small—the latter, known as "sprue," doing good duty in soups. Bunch them up neatly, in from fifty to one hundred shoots, according to circumstances, taking care to have all the points level, the stalks being duly shortened to near one length. Market-growers use a simple little contrivance for arranging the shoots. If not wanted for immediate use, the bunches may be stood in shallow pans of water in a cool dark shed for one or two days, but it should be borne in mind that fresh-cut Asparagus is the best.

In packing the shoots great care must be taken not to damage the points. Small quantities may be wrapped in paper and placed in layers, with the base of the shoots against the ends of the box in which they are packed. Larger quantities may be packed surrounded by fresh long grass, in "flats" or shallow hampers with lids, filling the package so that the lid when closed will hold the contents in position.

BEANS.—Broad Beans ought to be gathered when the seeds in the pods are not more than two-thirds grown; some prefer them when only half-grown. They can be kept fresh for about two days in a cool dark shed. They are easily packed. A corner not far from the top of a mixed hamper may be devoted to them, while the earliest are sent to the markets in half-sieves and bushel-sieves, later heavier supplies being consigned in bags of two bushels.

Dwarf French or Kidney Beans grown under glass ought to be gathered as soon as they approach full size, not leaving them long enough to become stringy, which they may do in a few hours. Grade and tie them up neatly in bundles of fifty or so, the stalks being level so that they all touch the water in the pans they are stood in till required. They are not so tender after standing two or three days in water. Pack the bundles flat and in boxes with other choice vegetables, and if they can be surrounded with Spinach leaves so much the better. When more plentiful, and grown in the open, they are not bundled.

Runner Beans should also be kept somewhat closely gathered, and certainly never left on the plants till the pods present a swollen appearance. They travel well packed with other vegetables, always providing nothing heavy or rough is placed over them. Those intended for the markets are packed in half-sieves and bushel-sieves, heaped measure usually being given, a covering of long grass, kept in place by stout benders, completing the packing. Later in the season they are packed and despatched in two-bushel bags.

BEET.—The Turnip-rooted are fit for use first, the first to become stringy, and they ought to be used first. They should be well washed before sending to the kitchen. The tap-rooted varieties ought to be lifted carefully, to avoid breaking the coarser side-roots, damaged Beet losing much of its attractive colouring when boiled. Severe frost, if it does not actually destroy Beet, is liable to seriously impair the quality, so that lifting and storing in October is always advisable. Do not cut but twist off the tops, and clear the roots of soil clinging to them. Store in cone-shaped mounds, crowns outwards, surrounding the roots with sand, fine soil, or ashes, and covering with fresh straw, in its turn covered heavily with soil. Provision should be made for an escape of what little vapour may form during the first weeks, and the position selected for the heap ought to be well drained, while rats should be watched for and destroyed. Beet may also be stored in a cool, dry, dark shed or cool cellar, and in some instances will keep fresh and plump without a covering of sand or soil. Beetroot is marketed either by the bushel-basket or loosely by the tally of sixty.

BORECOLE.—Those who would prolong the supply of greens should keep gathering them closely whether required for use or not. Once the shoots harden for flowering it is not much use leaving the plants on the ground. Borecole tops are packed flat in hampers, while the side-shoots or greens are often used for surrounding choicer vegetables near to or quite on the top of the hamper. Tops are usually marketed in sieves and crates, and the greens in bags.

BROCCOLI.—At all times coarser than Cauliflowers, this difference becomes still

further emphasized when no pains are taken in keeping the least self-protecting well covered with some of the leaves of the plants —duly snapped off and tucked closely over the curds. Thus covered they remain fairly clean and white in appearance and consequently worth more. Medium-sized to small whole heads are best for the table, and the Broccoli must, therefore, be cut before it has attained to its full dimensions. This applies more especially to produce grown for home consumption. Autumn Broccoli pays well for lifting with some soil about the roots and storing somewhat closely in deep pits or beds in cool houses or temporary frames, where they will give a long succession of useful heads. Main and late crops may be retarded by lifting in April and replanting in a north border, disposing the plants rather closely in a sloping direction and firmly packing rich soil about the roots. This is better than suspending the plants, with hearts partially developed, in cool dark cellars.

Broccoli that is to be packed ought not to be entirely denuded of leaves, enough being left to protect the hearts. Pack closely and on their sides, somewhere about the middle of a large hamper of vegetables. Whole train-loads of crates of Broccoli are despatched from Cornwall to other parts of the country during the winter season.

BRUSSELS SPROUTS.—Coarseness in these is decidedly objectionable, medium-sized to small close Sprouts only finding favour with cooks in good establishments. They ought to be cut or snapped off, not stripped away with a portion of the stem attached, and the stumps thus formed produce a second crop of small Sprouts, and later on an abundance of greens. Do not cut the Cabbage-like top off the plants before midwinter, as these serve to protect and assist in the production of Sprouts on the upper portion of the stems. Brussels Sprouts retain their freshness several days after collecting. They may be packed loosely in one corner of the middle or top layer of a hamper of mixed vegetables, while those marketed are usually packed in half-sieves, sieves, and frequently bags. Entire plants are marketed in some districts.

CABBAGES.—It is a mistake to defer cutting till the hearts are solid ; neat, little, quickly-grown, and not very solid, conical hearts being preferred, the earliest spring supplies in particular finding favour. Cabbages do not keep well cut, and they are seldom stored in pits for winter use. They are cleared of their coarser leaves and packed and marketed either by the tally or in crates similarly to Broccoli. Collards, or Coleworts, are bunched.

CARDOON.—As this plant is not hardy, and is rather bulky to store, it is a good plan to protect the rows, before the tops are injured by frost, with bracken or strawy litter. If preferred the plants may be lifted and replanted close together where they can be conveniently got at. If proper means have not been taken to keep the stocks clear of soil, they must be washed carefully, holding the hearts downwards. Before packing, trim freely, tie the stalks together, and pack them firmly.

CARROTS.—Young whole Carrots are the sweetest and tenderest when cooked, but medium-sized old roots can also be cooked whole and till they are tender and sweet. The coarser roots should go to the stables. Young Carrots are bunched, their tops reduced, and are then well rinsed in water. Early sown crops should be stored before the roots become too coarse. Later sowings keep in a much better condition if left in the ground and lifted when required, protecting the ground with long litter during severe frost, though frosts seldom injure the roots. Store exactly as advised for Beet. Pack them close together in the bottom of a mixed hamper. Their appearance is improved by careful washing, avoiding the use of a stiff brush, which may disfigure the skins. Any to be marketed should be graded, and they may be despatched in bags holding one hundredweight or more.

CAULIFLOWERS.—In order to ensure perfect blanching of the curds, and to a certain extent exclude butterflies followed by obnoxious caterpillars, tie the leaves of advancing Cauliflowers over their hearts somewhat closely. Cut while the curds are still close and solid, shorten the outer leaf-stalks, and retain the inner protecting leaves. Autumn crops may be lifted, stored, or otherwise protected, much as advised for early Broccoli. They are also packed and marketed in the same way.

CELERIAC.—This, the Turnip-rooted Celery, being grown completely on the surface of the ground, must be protected from frost. The roots should be lifted, cleared of their tops, and be stored in sand or finely sifted ashes in a cool shed.

CELERY.—The plants, after lifting, should be cleared of the coarser outside stalks and roots, and then be tied firmly to keep them in shape. For packing, rather more of the leaves should be trimmed off, and they can then be laid closely together in a mixed hamper, somewhere about the middle layer. For the markets the plants are trimmed moderately hard, washed carefully heart downwards, and, in addition to each receiving one tie near the top, they are also bunched into flat neat bundles of six, nine, or twelve. With a little practice men become expert in this bunching of Celery, and during the season many are wholly employed in preparing this important crop for the markets.

In America late Celery is lifted, slightly trimmed, and bedded in pits, where a heavy protection of straw can be given. In this country there is less need for this precaution, but it is well to protect with fresh, dry bracken or strawy litter when a severe mid-winter frost is anticipated.

CHICORY.—Well-blanched tops of these can be best produced from strong roots in a Mushroom-house. For home use the leaves only may be cut, and successional supplies be had from the hearts, but for travelling and marketing the tops should be cut before they spread, each with a thin part of the crown of the root attached, to keep the tops together. Pack them with other tender vegetables in strong boxes, these in their turn being placed in the bottom of a large hamper. If intended for the markets pack them in flats.

CUCUMBERS.—These, to be wholesome, must be grown quickly, and not be left hanging on the plants till the skins have thickened and lost their fresh dark-green appearance. Nor do they, as a rule, keep well off the plants. If not wanted for immediate use, cut before they are too old, and stand them upright in a cool dark shed with their foot-stalks in pans of water. Thus treated, however, they are apt to become somewhat hard. For cooking purposes Cucumbers may be allowed to hang rather longer on the plants.

When handling Cucumbers be careful to preserve the bloom on the skins as much as possible, and when packing, wrap each Cucumber separately in soft paper and pack closely in a box. For the markets they are usually packed in flats, or shallow baskets, with long fresh grass between the layers, topping up with more of the same, the lid closing down tightly on this. Ridge Cucumbers are not so easily disfigured, and may be packed in any kind of basket without much packing material, except for the purpose of topping up.

ENDIVE.—Healthy, well-blanched, clean hearts of Endive rarely fail of appreciation. Large batches, unless for market purposes, ought not to be blanched at one time, blanched Endive not keeping well. It should not be cut long before it is wanted for use. If it is to be packed, be careful to cut a portion of the underground stem with the plant, the better to keep it together, and pack closely on their sides in baskets or boxes, protecting the hearts with some of their outer leaves drawn up rather lightly. They are packed in this way in flats when sent to the markets. Novices require to be told that the Broad-leaved Batavian is the best for winter use, the Green-curled not keeping so well.

HERBS.—Most herbs used in cooking are naturally best gathered fresh from the plants, and neat little bunches of all in season are generally included in the bi-weekly mixed hamper of vegetables. Some few kinds may be dried—cutting them before the flowers are far advanced,—bunched and hung up in dry, cool sheds for future use. Among these are Bush Basil, Sweet Basil, Sweet-knotted Marjoram, Mint, Sage, and Tarragon. Leaves and young shoots of Borage are used in the manufacture of claret cup; leaves of Chervil for flavouring salads; the young tops of Chives—which are constantly renewed by plants frequently cut over—as a substitute for young Onions in a salad; leaves and sprays of Fennel are principally required for cooking with certain kinds of fish; and the fresh tops of Mint make the best mint sauce. Parsley is simply indispensable for flavouring and garnishing all the year round, and sprigs of Thyme are wanted for flavouring generally.

KALE.—See BORECOLE.

KOHL RABI.—In Germany and other Continental countries Kohl Rabi is largely grown either in preference to or as a substitute for Turnips, but with us it is not so popular as it deserves to be. As a vegetable it is of no value when grown larger than a medium-sized Whitestone Turnip, and it is occasionally very acceptable at a time when hot weather has spoilt Turnips. Prepare, clean, store, or pack the roots as advised for Turnips.

LEEKS.—Leeks grown in holes formed with a stout dibber are more easy to prepare for the kitchen than are those that have been cultivated in trenches and duly soiled up to effect stem-blanching. Roots should be trimmed off, the tops considerably reduced, and each Leek be washed with the heart downward. They are perfectly hardy, and ought to be dug only as they are required. In the spring what remains of the crop may be lifted and heeled in on a north border, this prolonging their season. Leeks will stand rough treatment as regards packing. Those sent to the market are tied together in bundles.

LETTUCES.—This salading, to be good, ought to be grown quickly, well-blanched hearts being required. Opinions vary as to the superiority of either Cos or Cabbage varieties, some connoisseurs preferring the solidity, crispness, and sweetness of the former to the softer Cabbage sorts, which are apt to become quickly flabby in or out of salads. Lettuces ought not to be cut long before they are wanted for use, and any that have to be sent to a distance should not be exposed to winds and sunshine longer than is necessary. They keep fairly well for a few days if drawn from the soil and arranged with their roots in pans of water under cover of a cool shed. Late in the autumn those with hearts already formed may be lifted and replanted close together in frames, and, if protected from frost, will carry on the supply till midwinter.

The early Lettuces grown under glass, and more especially the Cabbage varieties of the early Paris Market type, are very tender and must be packed with more than ordinary care. Very few of the outer leaves should be removed, and those reserved ought to be made to enclose the hearts thoroughly, packing all on their sides closely in boxes, which in their turn may be enclosed in the hamper of mixed vegetables. Those grown in the open may be packed to form the topmost layer. For the market, house- and frame-grown Lettuces are packed in various kinds of baskets, the Cos varieties on their sides and the Cabbage varieties heart upwards.

MAIZE or INDIAN CORN.—During very hot summers Maize succeeds best with us, when the popular Peas often fail. As its culture becomes better understood, it will undoubtedly rise in popularity, as each year it is more and more sought after. Many who have grown Indian Corn failed to give it a second trial partly because of the common mistake of gathering and cooking the "cobs" before the grains had really developed, the soft young grains tasting like so much slightly-sweetened water. It is just as reasonable to cook Peas when about one-third grown. The other extreme, or nearly ripe corn, should also be avoided, the fully-developed yet comparatively young grains being tender, sweet, and juicy. The later supplies keep best on the plants, which may be lifted and stored out of reach of frost in the autumn. Pack the ears of corn just as they are gathered, as in this state they are enclosed in wrapper-like sheaths.

MUSHROOMS.—"Buttons," or those not unfolded, are appreciated for some purposes, but the nearly or quite fully-developed Mushrooms known as "broilers" are more nutritious and richer in flavour. It often happens that some of each are attached to the large clusters of Mushrooms that have to be twisted out of the beds, and these are usually packed separately by those supplying the markets. Every care should be taken to keep the gills of the developed Mushrooms perfectly free of soil and grit. The stalks ought to be shortened only, cooks having a use for these as well as the tops.

Under no conditions do Mushrooms long retain their freshness, the gills quickly becoming soft and changing from pink to black. Small quantities may be packed in a shallow, paper-lined box, two layers deep and all stalks downwards, and if there are not enough to fill the box, fine wood-wool should be employed both above and below the Mushrooms, as loose packing may result in much injury to the contents of the box. Market-growers either pack in 1-pound punnets, these in their turn fitting tightly in boxes large enough to hold either six or one dozen punnets, or, in the case of heavy consignments, quarter-sieves and handled baskets are used. As before stated, they are well graded, while the baskets lined with paper are closely filled, all the Mushrooms being packed stalks downwards, not only to keep the gills clean, but also because they are less liable to break up than they would be with their stems upwards. The ends of the paper, purposely left over the sides of the baskets, are turned tightly over the Mushrooms, and stringing completes the process.

MUSTARD AND CRESS.—This small salading, to be at its best, must be grown quickly and in the dark till the stems are

from 1 inch to 1½ inch high, as unless so grown up to within, say, two days of cutting, the stems are apt to be short and green, whereas they ought to be blanched and long. Both leaves and stems ought to be perfectly free of grit, rinsing not easily clearing produce not previously kept free of soil. Mustard and Cress should be cut with a long sharp knife, and at once placed tops upwards tightly in punnets. If the punnets are to be enclosed in a hamper they ought to be well papered over, but they travel best as sent to the markets packed closely in boxes just deep and wide enough to hold either six or twelve punnets.

ONIONS.—For salad purposes only quite young Onions should be used, the white-skinned Tripoli or White Lisbon being the mildest and sweetest flavoured. Immense quantities of these, principally autumn sown, are grown for the markets, and these are duly bunched in the spring. The old-fashioned plan of stringing Onions up in bunches or ropes, and suspending these in a cool, dry room or shed, is still the best, Onions keeping admirably thus treated. Well-ripened Onions will stand somewhat rough treatment, and may be packed in the bottom of a mixed hamper; large quantities may be sent in sieves or bags.

PARSNIPS.—Very large roots of these are not desirable, as they cannot well be cooked without being cut up, whereas, to be really good and digestible, Parsnips ought to be cooked steadily until they are soft to the core, after which they may be duly quartered or otherwise prepared. They keep badly when out of the ground, becoming shrivelled and tough. Left where they are grown they can be dug as required, especially if the precaution is taken of covering part of the bed before it is frosted with straw litter. In the spring what is left of the crop may be dug, and the roots stored in moist sand at the foot of a north wall or other cool situation. Small quantities are packed with other heavy roots in the bottom of a mixed hamper, and large quantities may be sent to the markets in bags or boxes.

PEAS.—When to gather Peas ought to be decided by the wishes of those for whom they are intended. In some establishments they are preferred when about two-thirds grown, and most people like them fully grown but not in the least degree old. Some varieties remain tender and sweet longer than others, and rapid maturation has also to be reckoned with in some seasons. If gathered before they are required for use they are liable to become somewhat tough, but where they have to be sent long distances to town-houses this cannot well be avoided. Shelling the Peas and packing them in paper bags economizes space, but they keep freshest when left in the pods. They may be packed loosely in one corner not far from the top of a mixed hamper, or in any position where the pressure is not likely to crush them. The earlier consignments to market are packed in half-sieves and sieves, and grassed over, with benders to keep all tight; when more plentiful, "pads" or two-bushel baskets with lids and bags are principally employed.

POTATOES.—Ashleaf Kidney and such sorts as Harbinger, Midlothian Early, and May Queen may be lifted for use when the tubers are not more than half-grown, but with the majority of sorts the immature tubers are not good to eat when cooked. A considerable amount of judgment ought, therefore, to be exercised in the matter of selections of varieties for early lifting, as "new" Potatoes. When they are dug up they ought to be quickly moved into a dark place, exposure to the light and sun turning them green and greatly impairing their flavour. They ought not to require washing, but the later supplies may be washed, as they then present a better appearance. Those who are concerned about the cooking of Potatoes are advised to grade them for the kitchen, sending the larger tubers at one time and the smaller at another, or otherwise the cooking will be unequal, very few cooks taking the trouble to grade the tubers. Potatoes that have been allowed to sprout are of inferior quality as food. For that reason it is well to provide a cool, dark shed on the north side of a high wall for the storage of Potatoes, as in these places they can be watched more closely and turned oftener than when stored in earth and straw-covered heaps.

New Potatoes should be enclosed in square punnets, lined with soft paper, and placed in the middle of a mixed hamper of vegetables. Those sent to the market are variously packed in cross-handled, paper-lined baskets and quarter-sieves, and a little later barrels are principally used, the topmost tubers being covered with haulm or grass and kept down either by basket-lids or benders. Main and late crop Potatoes travel at a cheaper rate if packed in bags.

Hundredweight bags are principally employed by market-growers, and they are conveyed at ton rates.

RADISHES.—Quickly-grown and pulled when quite young, Radishes are crisp, tender, and sweet, whereas, if grown slowly or left till they are old before drawing, they are tough, stringy, hot, and indigestible. Naturally they are best when first pulled, but if not unduly exposed they will keep good for several days. They should be bunched, have their tops, if somewhat bulky, trimmed, and the roots rinsed in clean water. They may be packed with other salading, or, if for the market, in flats surrounded with grass.

RHUBARB.—The most pleasing in point of colour and the most delicately flavoured Rhubarb is that developed in heat in the dark. Thus produced it is brittle, and should be carefully handled. The leaves, if short, need not be interfered with, otherwise they may be reduced in size, but the blanched tops improve the appearance of Rhubarb. Tie up in bundles for the more convenient handling and packing. That raised in the open is harder and stands rougher handling. Market growers tie forced Rhubarb in small bundles of two to four sticks, not removing the leaves. Later rather larger bundles are made. It is packed closely in hampers or crates.

SALSAFY.—Roots of this vegetable do not keep well out of the ground, and the usual practice is to leave them where grown till they are wanted for use. In the spring, the ground being wanted for other vegetables, what is left of the crop may be lifted and laid in closely on a north border. When forked up the roots should be washed clean, and if to be packed, tied in small bundles to be placed in the hamper among other coarse vegetables.

SAVOY CABBAGES.—Too often these are grown to a great size and quite spoilt through having become coarse. Small hearts are the best. They are prepared and packed for private use or for sale much in the same way as ordinary Cabbages.

SCORZONERA.—Treat precisely as directed for Salsafy.

SEA-KALE.—Sea-Kale ought to be well grown, in order to have strong crowns, as fine succulent growths cannot be forced out of weakly plants. To have it mild in flavour it must be forced in the dark. Too often Sea-Kale is allowed to become long and comparatively old before it is cut. Left till the flower-stem develops, it becomes hard, and is practically spoilt. The shoots ought to be graded, if not by the grower certainly by the cook, and neatly tied into bundles. If not wanted for immediate use, stand the short length of stem connected with the growths in a pan of water in a cool dark shed. This is better than leaving the produce uncut. When packing, wrap each bundle in clean packing-paper and place in a box with other choice vegetables. Sea-Kale for market ought always to be cut with an inch or more of stem attached, as this serves to keep the growth together and further tends to preserve its freshness. They should be tied up in compact bundles of a dozen growths or more. Not infrequently the lower half of the bundle is enclosed in blue paper, and packed tightly in deep punnets, which in their turn are packed in hampers or light boxes.

SPINACH.—Large succulent leaves of Spinach are most desired, and failing these quite young plants or thinnings are sometimes substituted. If exposed after gathering Spinach quickly becomes flabby, but retains its freshness fairly well in a hamper, drawer, or box, in a cool place. New Zealand Spinach (*Tetragonia expansa*) is very different in its habit of growth, the young tops of much-spreading plants being boiled. The leaves of Perpetual or Spinach Beet more nearly resemble true Spinach in appearance, but they are not so good in quality. Strong roots continue to produce leaves in succession to those gathered, and Spinach Beet may be said to be a hardy and reliable, if not particularly good vegetable. When packing Spinach it may be mixed with other vegetables that require to be kept fresh, or it may be disposed in bulk near the top of the hamper. Spinach is marketed in hampers, crates, and bags.

SUN-ROOT.—Sun-Roots (Jerusalem Artichokes) keep best when left in the ground where grown, digging them as required. In order to be able to accomplish this during severe frost, cover a portion of the bed with straw litter. When the tubers are sprouting, or say late in March, what remain of the crop should be lifted, cleared of shoots, and stored in moist sand and cool quarters.

Very large tubers are not desirable. The

white-skinned variety is usually preferred. It will not harm the roots if they are first washed and then packed loosely in the bottom of hampers, and they may be sent to the markets in bags in the same way as Potatoes.

TOMATOES.—Tomatoes are at their best when fully ripe. They may be well-coloured before this, but the flesh is comparatively hard and the pulp wanting in flavour; on the other hand, if kept till soft and flabby, all the brightness and much of the pleasing acidity is gone out of them. It is a mistake to suppose that fruit that are slightly ribbed are therefore inferior to those which are round and smooth. It is all a question of pulp, this being most plentiful in well-set fruit. Very solid fruit have too much core in them. The best-flavoured fruit are produced under glass. When fully coloured, or a little earlier if the fruit are inclined to crack, they may be gathered, to be ripening in paper-lined boxes in a warm dry room rather than exposed on shelves to the roasting effects of direct sunshine and heat. The larger fruit should go to the kitchen, the salad-maker having the choice of medium-sized, well-ripened, red or yellow fruit. Tomatoes produced in the open air may be ripened in boxes as advised for house-grown fruit. Not a green fruit should be wasted, as these mixed with Onions, hot spices, and vinegar form a most admirable pickle.

Tomatoes, although not easily bruised, ought to be packed carefully. If sent in small quantities in boxes, they should be wrapped separately in soft paper and packed closely in soft wood-wool, not more than two layers going into a box. The fruit ought to be coloured but quite firm when packed, fully ripe fruit turning out, after a long journey, soft and flavourless. Market growers pack most of their Tomatoes in either cross-handled baskets, holding about twelve pounds of fruit, or in narrow-necked quarter-sieves. These are lined with packing-paper, with long ends overlapping the sides. No other packing-material is used, the fruit, well-coloured, firm and carefully graded, being packed closely in layers till within 1 inch of the rim, or the proper weight is put in, when the loose ends of paper are folded over the fruit and this kept down by stringing over. Few complaints of bad packing or rough handling are heard of. The baskets having handles, there is no excuse for rough handling, and further, the baskets not being full up to the rims, they can be stacked one above another safely enough in the luggage-vans of passenger trains. It is not found that the fruit travel any better in handled baskets with movable lids, the latter only adding to the expense and worries of both packers and buyers. The quality and weight of fruit contained are stated in or on each basket. The outdoor Tomatoes, when produced in extra large quantities, are often sold by the bushel, and packed in flats and sieves, much as Apples are.

TURNIPS.—Unless quickly grown, Turnips are liable to be hot and stringy, and they deteriorate rapidly in hot weather. This can be prevented for a few days by storing in a damp dark shed, but they are never so good as when newly drawn from the open ground, so that it behoves the cultivator to make frequent small sowings rather than rely upon fewer large sowings, the aim being to keep up a supply of roots rather smaller than a cricket-ball. Prior to packing, trim off coarse root-thongs, if any, and much of the foliage, and place them in the bottom of the hamper. For the markets the earlier Turnips are bunched, from twenty to twenty-five roots going to the bunch. When much more plentiful, this being in the autumn and winter, the roots are topped and tailed moderately hard, and consigned in bags, Potato-fashion.

In some localities Turnips are liable to be destroyed by frost, and in all such cases the precaution should be taken of storing at least a portion of the late sown or main crops. Early in November the roots ought to be pulled, topped, and stored, taking care that they do not become heated. Layers of straw should be placed between them. Very late sowings can be protected by covering them with soil. Early in the year the heap should be turned and all growing shoots removed.

VEGETABLE MARROW.—As a rule the fruit is left too long on the plants. Cut when about 6 inches long, cooked and served exactly as grown, there being no skin or seeds to reckon with, this excellent vegetable will be found more like Vegetable Marrow than is the case when large fruit are cut, pared, quartered, and boiled. This plan of early cutting also possesses the merit of favouring the production of a far greater continuous crop than is the case when the plants have to bear the strain of forming large fruit and maturing seeds. Vegetable Marrows keep fresh for several days stored with their foot-stalks in a pan of water placed in a cool dark shed. Quite young fruit ought

to be packed similarly to Cucumbers, but the more fully grown fruit stand rougher treatment.

Market growers have to adapt their practices to meet the needs of their own particular districts or markets. In some towns very large Vegetable Marrows meet with most favour, in others the younger fruit is preferred. They are packed in flat pads and crates.

WATER CRESS.—The best produce is obtained from young plants in fresh soil over which 3 inches of clear water flows. The shoots should be cut over every week during the season, with a view to maintaining a supply of tender salading. Tie in bunches, rinse in clear water before the leaves become dry, storing for two or three days if need be, in shallow pans of water and a cool place. For the market large bunches are formed and packed in hampers, the lids closing down tightly on the contents.

HAMPERS OF VEGETABLES.—Large strong oblong hampers, duly shod, and strengthened by iron bands so formed as to be easily fastened down by means of a looped rod and padlock, are best for the carriage of vegetables. Ordinary oval-shaped, comparatively cheap hampers are neither convenient nor durable, and are dearest in the end. Where not less than two hampers are despatched to a town-house by rail every week, a set of four hampers will be required, as there is often a delay in getting the empties back. The hamper should be so topped up with lighter vegetables that the lids when closed will hold the contents firmly. If not well filled when started, the shrinkage that inevitably occurs is bad for the contents. Heavy hampers of vegetables ought, where possible, to be sent by express goods train, as by ordinary goods train they are liable to be delivered a day too late, and the contents, especially in hot weather, may consequently be spoilt.

ALLOTMENT GARDENING

Soon after the declaration of war in August 1914 it was recognized that gardens could play an important part in providing food for the people. Their owners were therefore urged to grow vegetables at once wherever possible, and the following spring saw food-crops cultivated by nearly every one who had a garden, large or small. Much land which had hitherto been allowed to remain derelict or uncultivated was dug and cropped with Potatoes and other useful vegetables. The movement received a great stimulus from an Order under the Defence of the Realm Act, 1914, to extend the existing powers of acquiring suitable land for the growth of food vegetables.

Local authorities were authorized to do what was necessary to fit the land thus acquired for cultivation, including fencing; also to provide seeds, manures, and implements at cost price to the cultivators.

By July 1918 returns showed that there were no fewer than 1,400,000 allotments in the United Kingdom, occupying in England and Wales alone some 200,000 acres. These cultivated plots in evidence everywhere led to the remark that " the war turned Great Britain into an island of gardens."

Most of this war-time gardening has been undertaken by amateurs, and it is with the object of assisting them in the correct methods of allotment gardening that a special section is devoted to it here.

Large towns provided the greatest number of workers in this national scheme of gardening, and although land is more difficult to obtain in and near towns than in rural areas, the difficulty was to some extent surmounted by appropriating vacant building land and other derelict spaces, and by utilizing land in the public parks and gardens. Much of the ground consisted of old pasture, which had remained uncultivated for many years. It is a popular fallacy that virgin soil, as waste land is popularly termed, will yield good crops without manure or dressing of any kind. It is true that old turf may contain a considerable amount of plant food, but it requires to be thoroughly broken up and decayed before this food is available. There is a danger also in digging virgin ground so deeply that the richer surface soil is buried out of the reach of the vegetables. Many failures in the first year of cultivating such ground are due to this cause.

Vegetables to be grown satisfactorily require, in addition to a supply of food at the roots, warmth, air, and moisture, and the operations of digging and manuring are, when properly performed, an aid to these requirements. Good digging means much in allotment gardening.

The most useful garden implement is the spade, and those who are skilled in its use will find that it is suitable for most ground operations. A small-bladed spade is better for amateurs unused to digging than one of large size. The fork is a valuable implement for breaking the hard subsoil, lifting root crops, loosening the surface soil, spreading manure, etc. Next to the spade and fork in usefulness comes the hoe, which is indispensable for the destruction of weeds, obtaining a fine tilth on the surface to prevent the soil from drying out rapidly in hot weather, making shallow drills for seeds, and earthing up Potatoes, etc. A rake is very serviceable for tidying ground and breaking down the lumps of soil when making a seed-bed. A garden line will ensure straight planting and should always be used in setting out crops. An iron-shod dibber is a handy implement for transplanting seedlings, and a trowel and hand fork will also be found of service.

PREPARATION OF THE GROUND

Soils vary so much that no hard and fast rules can be laid down for their treatment. They may be clayey, sandy, chalky, or peaty, the most fertile being those which contain a proportion of each of these materials, and are known as loams. The upper portion, known as the top soil, is that in which plants root and find nourishment; underneath this being the more close, solid strata, termed the subsoil. Where there is a good depth of rich upper soil the crops usually flourish, and one of the objects of tillage is to increase the depth of this fertile soil by breaking up the subsoil and incorporating with it manure, leaf-mould, vegetable refuse, wood-ash, road-sweepings, and in some cases lime. Some soils may be left undug until near the time for cropping, but others should be dug in the autumn and winter to receive the beneficial action of frost. Heavy soils consisting largely of clay, when well cultivated, usually prove the most productive. It is best not to cultivate such soils too deeply at first, but efforts should be made to provide good drainage, and any materials that will lighten ground, such as those mentioned above, should be dug in deeply in autumn and early winter. The soil should be thrown up in rough lumps so that the frosts, winds, sunshine and rain will act on it. Then, when spring arrives, it will fall to pieces easily and provide a suitable tilth for sowing and planting. Soot is an excellent dressing for heavy soil, and so is lime. The latter should be spread over the surface in late autumn and not dug in deeply, as it is washed down by rain. The effect of lime is to release the potash in clayey soils, to act as a sweetener by correcting acidity, and it is in itself a plant food. Two hundredweight of lime is a suitable dressing for a ten-rod plot. It should be slaked, which may be done by placing it in heaps and covering it with fine soil. Some soils are so heavy and wet that it is unwise to dig them much in advance of cropping. If disturbed in wet weather the surface becomes pasty and will take some time to recover. In digging any kind of soil take care not to bury it in big lumps which would remain throughout the growing season, for the roots of plants rarely or never enter clods. This precaution is necessary in ground intended for Potatoes, by far the most important crop grown on allotments. Cow manure and pig manure are unsuited for heavy soils, as they make the soil heavier, colder, and more retentive of moisture. Avoid treading on heavy soil when it is wet, and do not wheel manure on it except when the surface is dry or frozen hard. There is a great variety of soils of medium texture, which with proper management may soon be brought into good condition. The free use of farmyard manure greatly improves such soil, and if the manure is applied in the autumn it will be well decayed by the spring, and should not cause forking in the roots of Parsnips and Carrots.

Light soils have certain advantages, being easy to work and warmer than those of a heavy texture. They have their disadvantages also, one of the chief being that they are not sufficiently retentive of moisture. Where the subsoil is clay, some of the latter should be brought up and mixed at the time of digging with the lighter surface soil. Sand is poor in plant foods, and it does not retain long anything that is added to enrich it. Clay, on the other hand, is very retentive of plant food, and it is to the absence of clay that the poorness of sandy soils is to be attributed. If either clay or marl—a term used for chalky loam—is applied in autumn or early winter it will greatly improve poor, light land. Light soils, being already in a fine state of division, do not require to be rough dug in autumn or early winter.

There are several ways of digging, namely: (1) ordinary digging; (2) forking; (3) trenching, *i.e.* turning over the soil to a depth of two or three feet; (4) bastard-trenching, or turning over the top spit only, and loosening the subsoil by forking and manuring; (5) ridging, or placing spadefuls of soil in rows so that they obtain the maximum of frost and air.

In ordinary digging it is best not to trust to the eye, however true, but to make use of the garden line: this will give a guide to the first spit, which should be dug to the full depth of the spade. When the first spit is turned over the soil below should be loosened with a fork. It is essential that the digging should be uniformly deep, partly because each trench has to be filled with the earth taken from the next one, and it is only by even digging that an even surface can be secured. When the first row is opened and

the bottom loosened before the soil from the next row is turned on to it, manure of some kind should be put in. It will then serve the purpose of holding water, keeping it available for the thirsty plants in mid-summer. Manure is not all of one kind; that from the stable and farmyard is best, but it is not always obtainable. The decayed leaves of the hedgerows are not to be despised, as they are a good water-holder and form humus by decay. Humus provides a medium in which fertilizing bacteria work and thrive. Good soil teems with them, and they enable the roots of plants to take up the nourishment it contains.

Trenching enables the roots to penetrate deeply and thus support the plants during drought. In trenching, first remove all the top soil from one end of the plot for about a yard in width, and place it near where the work is to finish. Then remove the subsoil, a spit deep, to the same spot. Now you have a trench two spits deep, with hard soil at the bottom. Fork this up, and lighten it with any suitable material, such as manure or horse-litter. The diagram on p. 199 will explain the process. If the plot is sufficiently wide another plan may be adopted to save carting soil to the opposite end. Stretch the garden line lengthways along the middle of the plot and trench one half at a time. As the work will finish at the same end as it was started from, only on the opposite side, the soil from the first trench is put there to fill in at the finish.

It is a great advantage when laying out land for allotments to make the plots of uniform size so that the pathways intersecting them are straight and of the same width. A common mistake is to make the paths too narrow and inconvenient for the use of wheelbarrows.

The verge or boundary of the plot should be a few inches away from the edge of the path, so that a narrow, shallow "V"-shaped trench is made. This cuts off the soil of the plot from that of the path, and has many advantages. Weeds from the grass path are not so likely to encroach on the cultivated ground, and it helps to keep the path dry.

The weeds as well as the old turf should be buried in digging, but there are certain weeds, such as Docks, Creeping Potentilla, Couch Grass and Bind Weed, which ought to be removed and burnt. The garden fire not only disposes of rubbish but it also provides in the ash a valuable fertilizer, Potash. Mixed with soot or lime, it is an excellent soil dressing. For example, seedling Turnips dressed with this mixture when the leaves are wet with the morning dews are protected from the ravages of the Turnip-fly. When a bonfire is properly made it will burn any kind of vegetable matter, however sappy and green it may be. To start the fire obtain a few stout sticks, such as old pea or bean sticks, and push them in the ground obliquely so that the tops meet in the centre. Arrange some dry fuel in the centre of these and cover the sticks with some of the driest material to be burnt. Light the fire on the windward side, and be ready to cover with fresh fuel any place where the flame breaks through. When the fire is going well it will burn almost anything combustible. The ash should be collected and stored in the dry for use in spring. It is an excellent fertilizer for Potatoes if sprinkled on the soil before the seed Potatoes are put in. Another use of the garden bonfire is to destroy garden pests, both insect and fungoid. The spores and mycelium of disease hibernate in old and decaying vegetation, and become active again in the spring. The eggs of many insect pests which are attached to old vegetation are destroyed in the same way.

MANURING

The chemical constituents of the food of plants are carbon, oxygen, hydrogen, nitrogen, sulphur, iron, phosphorus, potash, magnesium, and calcium. For the last seven of these we must look to the soil; and if only one of these chemicals is absent or insufficient the plant is handicapped, although it may possess abundance of all the rest. There is, as a rule, no dearth of iron in the soil. It is this which colours brown the clays and sands of this country. Plants do not need much iron, and they generally find all they want. Calcium in the form of chalk or lime also is present in most soils, but no harm is done by adding more, calcium being an important constituent. Sulphur compounds exist plentifully in nature, so that we need not concern ourselves particularly with these. Nor is magnesium likely to be lacking. The three most important are nitrogen, phosphorus, and potash, and the quantity of these three chemicals in the soil regulates the growth of the plant. The whole object of manuring

is to provide an adequate supply of them. All three may be present in other things besides animal manure, but dung is the best fertilizer, because it contains all the necessary plant foods as well as humus which the straw provides. Nitrogen is present in leaf-mould and other forms of decaying vegetable matter ; also in hair, hoof, horn, blood, fish refuse, soot, seaweed, and poultry droppings. Phosphorus is contained in guano and bones ; and potash in wood-ash, the flue-dust from blast furnaces, and in seaweed. Offal from the fishmonger mixed with dry soil and left in a heap until it is decayed is a good plant manure. Sweepings from the bootmaker's shop and hoof parings from the forge contain a considerable quantity of nitrogen. Soot from chimneys and flues should be collected and kept dry for use in spring. Sulphate of ammonia and nitrate of soda supply nitrogen ; superphosphate, bone meal and basic slag, phosphorus ; kainit or muriate of potash, potash. Bone meal and basic slag are two useful phosphatic fertilizers. Basic slag is slow-acting and should be applied to the ground in autumn at the rate of 4 oz. to the square yard.

Carbon, an important plant food, is obtained from the atmosphere. Green leaves assimilate carbon under the influence of sunlight. This is why most plants must be allowed plenty of sunshine and fresh air.

The best time to apply farmyard manure is the autumn, for then it will be thoroughly decayed by the spring and ready for the plants to make use of, the foods it contains enabling them to make good growth at the start, which is important. Fresh dung, often spoken of by professional gardeners as poisonous to plants, is of no use to them until it has decayed. If used in spring and summer it is best placed on the surface as a mulch, where its manurial properties will be washed down by the rains to the roots, the litter serving to prevent evaporation of soil moisture in dry weather. Quick-acting manures that are readily soluble, such as nitrate of soda, should only be used for growing plants.

A good substitute for farmyard manure is leaf-mould, made from the leaves of beech, oak, and other trees. Where trees are plentiful there is usually an accumulation of leaf-mould to be found beneath them, and in woods of long standing it sometimes forms a deep layer of rich vegetable mould. In addition to the plant foods contained in dead leaves or leaf-mould, it serves to lighten heavy soils and adds body to light ones.

Where seaweed can be obtained easily it well repays to collect it for the garden. Seaweed may be dug in during the autumn similar to stable manure, or it may be placed in a heap and mixed with lime and soil to form when rotted a compost for use as a top-dressing, or as a substitute for farmyard manure. Rotted seaweed is good as a top-dressing for asparagus and sea-kale. It contains a considerable amount of potash, and is on that account recommended as a manure for Potatoes. Road-sweepings containing horse-droppings and free from oil or tar, if stored for a time and turned frequently to allow the air to sweeten them, are good to mix with heavy soils.

Poultry- and pigeon-dung contains nitrogen and phosphorus. The droppings should be dried and mixed with fine soil before use. Both pig and cow manures are good for light soils, as they serve to retain moisture in the ground in summer. These manures are best when plenty of straw is mixed with them, as it helps to keep the soil open. Fresh horse-dung should be mixed with dead leaves or some such littery material, or fibrous turf that has been stacked for about twelve months may be mixed with it, as it will absorb the ammonia and increase the bulk. Manure water is probably the least expensive and most easily obtained fertilizer, as well as one of the best. It may be applied to all growing crops. It is easily stored in a barrel or a galvanized dustbin with a tight-fitting lid. The manure should consist mainly of horse- and cow-droppings and soot which can be tied in a piece of sacking and dropped into the water. The liquid should be about the colour of pale beer when used. Soot alone tied in a piece of sacking and placed in the tub of water can be used in the same way.

The rules to be observed in applying concentrated fertilizers are : lime, basic slag, bone meal, superphosphate, and kainit should be applied on the surface and lightly forked in.

Sulphate of ammonia, nitrate of soda, sulphate of potash, and guano should be spread on the surface to be washed in by the rain. Lime should not be mixed with manures but used alone. Basic slag contains a lot of free lime, and should also be used alone. Superphosphate of lime should be applied to light soils in the spring, but basic slag is best applied in the autumn.

Different manures have different effects on crops. Stable manure, although good for all crops, can be used in excess. This is also true of chemical fertilizers.

CROPPING

A ten-rod plot is a convenient size for an amateur to cultivate in his spare time, and if properly managed it should provide a supply of useful vegetables all the year round. The most serviceable crops are Potatoes, Parsnips, Carrots, Turnips, Jerusalem Artichokes, Beet, Onions, Leeks, Dwarf Beans, Runner Beans, and the various members of the Cabbage family, including Cauliflowers, Broccoli, Brussels Sprouts, Kales, and Savoys. Next in value come Broad Beans, Peas, Celery, Shallots, Spinach, Endive, and Sea-kale. Outdoor Tomatoes do very well in some seasons, and if all the fruits do not ripen the green ones may be used for making jam or chutney. Marrows and Gourds are easily grown, though their food value is not great, and they occupy a considerable amount of ground. Lettuces, Radishes, and Mustard and Cress are easily grown and are good as salads.

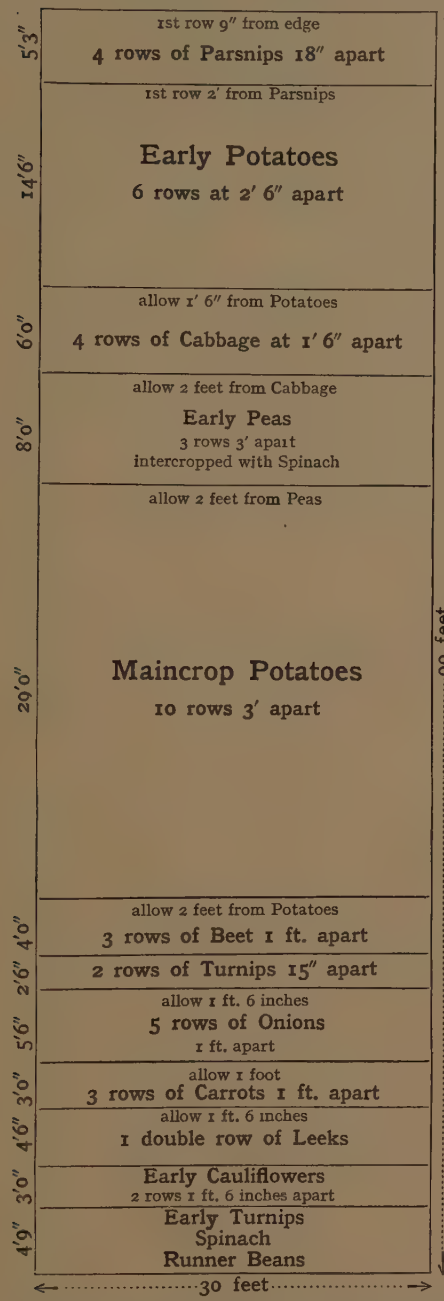

Fig. 200.—Method of cropping a ten-rod plot (90 feet × 30 feet). Winter Green Crops may follow Early Peas; and Celery Early Potatoes. Late Turnips can succeed Cabbages.

A moderately tall growing crop, such as Cabbages, which can well look after them-

A cold frame is a good investment, and one of the best uses to which it can be put in summer is to grow Frame Cucumbers. In the late winter and spring it will be found invaluable for raising an early crop of Radishes and seedlings for transplanting in the open. In winter it may be utilised for protecting seedling Cauliflowers, Endive, Lettuces, and Parsley. A two-light frame is also handy for holding the various tools, which will occupy only a little space along the front. It is essential to keep tools with wooden handles in the dry, as exposure to the weather causes the handles to crack and splinter and the iron parts to rust.

For the novice it is better to attempt the cultivation of a few things well the first season; and a start might be made with Parsnips, Potatoes, Onions, Carrots, Turnips, and various green crops. No vegetable is better for a first crop on newly turned soil than Potatoes, and at least one-half of the plot should be cropped with them. The reason why the soil is improved when this crop is grown is because of the number of times it is turned. Weeds seldom trouble Potatoes, because the soil is so frequently disturbed, whilst in summer the haulm grows so thick and dense as to entirely smother any weeds that may spring up beneath it.

In all systems of cropping care must be taken not to plant a tall-growing vegetable too near a dwarf-growing kind. For example, Potatoes should not be put close to rows of Carrots and Beet, as the haulms might fall over and smother their neighbours.

selves, would be much better. Nor should tall Beans be put next to Tomatoes, for the one would obstruct the light from the other. Some crops require better soil than others, and in any cropping plan this must be considered. Onions should be given the best piece of ground, whereas Turnips will succeed almost anywhere, their chief requirement being plenty of moisture.

Jerusalem Artichoke is not particular in its soil requirements, and is often grown in headlands and waste spaces. Deep-growing root crops, such as Parsnips and Carrots, require a good depth of fine soil that was well manured for a previous crop. For Leeks and Celery it is necessary to make trenches and work a good layer of stable manure into the bottom, with enough soil on the top in which to plant the seedlings.

This plan of growing crops in trenches with dung at the bottom is also followed very successfully with Peas and Runner Beans. All such crops require plenty of moisture in summer, and the value of the dung at the bottom of the roots is not so much to feed the plants as to hold moisture and provide a damp medium for the roots.

Where the ground has been dug in autumn or winter and is ready for cropping by the time the new year arrives a start may be made in February with the sowing of Parsnips, Broad Beans, and early Peas. Jerusalem Artichokes may also be planted in February, and if these four are got in early in the year it will leave less to be done when the busy time of March and April arrives. It is not too soon in February to sow in a cold frame early Lettuces, summer Cabbages, Onions, Leeks, early Cauliflowers and Brussels Sprouts. The grower should endeavour to adopt a system of cropping whereby a crop follows on as soon as one is cleared.

The first crops to be harvested are Spinach, Turnips, early Potatoes, Shallots, early Peas, and Broad Beans, and when these are cleared in early July they may be succeeded by Celery, Turnips, Kohl-rabi, Brussels Sprouts, Savoys, Cauliflowers, and other green crops; shorthorn Carrots, Beet, Endive, and Lettuce.

The garden year may start in almost any month, but in many respects February is the best time for an amateur to commence garden operations other than those of digging. In this month the days begin to lengthen, spring is approaching and winter is almost over, making the cultivator long to get to work again. Even if all the plot is not dug by February a start may be made with seed sowing and, as the season advances, the ground will get drier and digging operations become easier. Of course March is the great month for seed sowing, and while it is well to get the crops in early, it is a mistake to sow on land that is cold and wet; it is much better to defer sowing until the ground is in a friable condition, even if it entails waiting a whole month or more.

Parsnips planted in May have been known to give almost as good results as those sown in February, and the same is true with regard to Potatoes; it is better to plant them late in soil that is dry and warm, than to plant early in cold, water-logged soil.

A garden-line should always be used when making rows for planting seeds. The line should be stretched tightly and rest just level with the surface; the hoe is the best implement for making the drills, and the foot should be placed on the line as the hoe is drawn close to it. For small seeds draw a drill about an inch deep in order to allow a covering of fine soil to protect the seeds from birds. Carrots, Turnips, Radishes, Lettuces, and Cabbages should be sown at this depth, but for Broad Beans, Runner Beans, Peas, and Dwarf and Haricot Beans a depth of 3 or 4 inches is necessary. It is best to sow thinly using reliable seeds, which are always the most economical in the end, if a little dearer to purchase, thin sowing meaning a saving of labour in thinning the seedlings. Large seeds are best placed in twos or threes at the proper distance apart. For Parsnips it is a good plan to hold a few seeds in the left hand and with the finger and thumb of the right hand pick out two or three and place them where a Parsnip will occupy the space, repeating this every 6 or 8 inches along the line. It will be an easy matter to draw out the one or two surplus seedlings from each group when they are up. Thinning should always be done early, as when plants are crowded they grow tall and impoverish each other. Sturdy, stocky growth is always best, as it indicates vigour and robustness, and the plants have a good start. It is a common mistake of amateurs to attempt to grow too many plants in a given area by crowding them in the rows and not allowing sufficient space between the rows themselves. It may appear too much space to give the room advised by experts when the ground is clear and the seeds are being sown, but if the crops are to succeed they must have room when they are full grown; moreover, space will be needed to permit of such operations as hoeing and weeding. The distances advised below for planting the various crops

are the minimum to allow, and those who desire extra fine produce would be well advised to err on the side of more rather than less space.

As soon as the seeds are sown, the surface should be made level and, unless the soil is very moist, the ground along the rows made firm by treading. Most seeds germinate best in firm ground mainly because the particles of soil hold moisture longer when they are close together. It is a well-known fact that corn comes up best and strongest in the ruts where carts have passed along the field, and where depressions are made by horses' hoofs as the hunters pass over the fields in early spring. For some crops, Onions for example, it is essential to make the soil quite firm, the usual practice being to tread it well. This should be done when the soil is dry and friable on the surface, otherwise the treading would cause it to cake, and seeds need air as well as moisture and warmth to germinate. Birds greedily eat the seedlings of some vegetables, and others are subject to the attacks of insects, such as the Turnip-fly and Onion-fly. Dusting the rows with a mixture of wood-ash and lime or soot is one of the best methods of deterring both birds and insects from attacking seedlings. The dusting should be done when the leaves are wet with dew in the early morning or after a shower. Besides serving as a protection these materials stimulate growth; as the plants get older they are less susceptible to attack.

Certain vegetables, such as Onions, all the members of the Cabbage family, Leeks, Celery, Lettuces, Endive, Peas, Beans of all sorts, and Parsley transplant with ease, but others, such as Parsnips and Turnips, Beet and Carrots, are seldom a success when transplanted. The best time for transplanting is in showery weather, and late in the day rather than early, as the plants then get the benefit of the night dews, which assists them to recover quickly, and they will be less liable to droop and wither. Large seedlings, if set with a dibber, require that the hole should be made and filled with water before the roots are inserted, first allowing the water to drain away, otherwise the soil would be so pasty that it would be impossible to make it sufficiently firm about the roots. A good watering after the plants are set is a great advantage, and if the weather is dry it may be necessary to give other waterings to enable the roots to become established.

The following table shows the time for sowing and planting for successional cropping, with the distances at which the various crops should be set.

Varieties of Vegetables suitable for Allotments

Beet.—Improved Globe, Crimson Globe, Blood Red, Dell's Crimson, Nutting's Dark Red.

Broad Beans.—Green Windsor, Mammoth Long Pod and Prolific Long Pod.

Borecole or Kale.—Cottager's Kale, Tall Green, Green-curled Dwarf.

Brussels Sprouts.—Scrymger's Giant Exhibition, Paris Market, and The Wroxton.

Cabbage.—Early varieties: Ellam's Early, Harbinger, April, and Flower of Spring. Main crop varieties: Enfield Market, Wheeler's Imperial, Offenham.

Broccoli.—Walcheren, Perfection, Veitch's Self-Protecting, Early Purple Sprouting.

Carrots.—Early Scarlet Horn, Scarlet Intermediate, Early Nantes, James's Intermediate, and Long Red Surrey.

Cauliflowers.—Early Autumn Giant, Early London, Veitch's Autumn Giant, Snowball.

Celery.—Sandringham White, Giant White, Aldenham Red and Solid Red.

Endive.—Batavian, Moss Curled.

Lettuce.—Paris White (Cos), All the Year Round (Cabbage).

Leeks.—Musselburgh, the Lyon and Prizetaker.

Vegetable Marrow.—Long White Trailing, Long Green, Pen-y-byd.

Onions.—Ailsa Craig, James's Long Keeping, Nuneham Park, Prizetaker, Bedfordshire Champion.

Parsley.—Giant Curled, Myatt's Garnishing.

Parsnips.—Hollow Crown, Student, Large Guernsey.

Peas.—Chelsea Gem, Little Marvel, English Wonder, Gradus, Chelsea Prolific, Duke of Albany, and Autocrat.

Radish.—French Breakfast and Scarlet Globe.

Spinach.—Victoria, Improved Round, New Zealand, and Perpetual or Spinach Beet.

Tomatoes.—Ailsa Craig, Sunrise, and Lister's Prolific.

Turnips.—Red Globe, White Stone, Green-top Stone, Golden Ball, and Garden Swede.

Potatoes.—Early: Duke of York, Midlothian Early, Myatt's Ash Leaf. Second early: Windsor Castle, British Queen. Main crop: King Edward, Arran Chief, Up-to-date, the Factor.

FRUITS FOR ALLOTMENTS

The most suitable kinds of fruit for cultivating on allotments are Strawberries, Raspberries, Red, White, and Black Currants, Gooseberries, Loganberries, and Cut-leaved Blackberry.

Strawberry layers need to be specially prepared and planted early to fruit the first season. The best are from plants which have been forced into fruit early in the same year, but these are rather difficult to obtain. The next best plants are those specially rooted in small pots. The soil for Strawberries should be dug deeply, and enriched with well-rotted manure. They should be set in rows 2 feet apart and 18 inches between; some growers set them 1 foot apart in the rows and move every alternate plant in the second year. Royal Sovereign, King George, and Givon's Late Prolific are first-class varieties.

Raspberries to obtain a quick crop should be planted in late autumn leaving the canes their full length and cutting down every alternate plant to within 1 foot of the ground. The uncut canes should fruit the following season, whilst the others will develop strong suckers for the next year. The old canes should be removed directly the fruit has been gathered to enable plenty of sunlight and air to reach the shoots of the current season and cause them to become firm and ripe. The rows should be 3 feet apart and the crowns 1 foot apart in the rows.

The Red Currant and the White Currant are varieties of the same species, and they both require to be pruned to very short spurs, at the base of which the fruiting buds develop in clusters. It is best to grow these plants with a stem as the ground can then be better kept clear of weeds. The Black Currant, on the contrary, fruits on the new wood, and in order to obtain plenty of young basal shoots the lower eyes are not removed when the cuttings are rooted, so that the plants continue to send up sucker shoots. In pruning the Black Currant most of the old useless wood should be removed each season after fruiting, but the young wood should be left. The Gooseberry is one of the easiest fruits to cultivate, and may generally be relied upon to crop well. The fruits develop on both the old and the new wood, therefore the only pruning that is necessary is to remove all suckers and such shoots as are needed to prevent overcrowding, keeping the centre of the bush open to allow the air and sunshine to enter freely and facilitate the gathering of the berries. The Loganberry and other members of the Bramble family, such as the Lowberry and the Cut-leaved Bramble, send out strong, sucker-like shoots—in the case of the Loganberry sometimes 20 feet long—and if the wood is well ripened the plants will fruit well every year. The old fruiting stems should be cut out, as in the case of the Raspberry, to which these brambles are allied, directly after the berries are gathered.

The Sutton is one of the finest of all varieties of Rhubarb, other good sorts being Daw's Champion and Champagne. The crowns should be planted in deeply dug ground, to which plenty of well-rotted manure has been added.

MONTHLY OPERATIONS

January.—During this month the soil is generally either too wet or too hard with frost to permit of ground operations, but whenever it is sufficiently dry digging should be proceeded with to get as much of it as possible ready for planting and sowing later. Towards the end of the month Broad Beans may be sown for transplanting in March; where frames are available Broad Beans, early Peas, early Cabbage and Lettuce should be sown in them for transplanting in the open in April. On a very sheltered, warm border sow early Peas, a round-seeded sort for preference. When the ground is hard with frost wheel manure on to the plot. Look over Spring Cabbages and where any of the plants have failed replace them with others from the seed-bed; this should be done in mild weather when the ground is fairly dry.

February.—The same crops as recommended for planting and sowing in January may be put in, and Jerusalem Artichokes and Shallots planted. Towards the end of the month a sowing of Peas may be made on land that is moderately dry, wet soil being bad for early Peas. Towards the end of the month Spinach and Parsnip seed may be got in. Sow early Cauliflowers, Leeks, and Brussels Sprouts in frames.

March.—Sow Shorthorn Carrots, Lettuce, summer Cabbage, Turnips, Spinach, early

Peas, Broad Beans, and Parsnips. Towards the end of the month make a sowing out-of-doors of Lettuce, Brussels Sprouts, Parsley, Leeks, Snow's Winter White and Late Queen Broccoli, early London and Autumn Giant Cauliflowers, Onions and Radishes. Sow Celery, Onions, and Leeks in frames. A few early Potatoes may be planted in a warm situation. They may need a little protection if they come through when the weather is frosty.

April.—Continue to plant the crops recommended for March, and towards the end of the month make the first sowing of Beet and French Beans. Finish the planting of early Potatoes and, as the season advances, put in the second earlies and follow with the main crop sorts. Raise Marrows and Cucumbers in warm frames, and in the second fortnight of the month sow Savoys, Curled Greens (Kales), early and late Cauliflowers, and further sowing of Turnips, Peas, Onions, Carrots, and Brussels Sprouts.

May.—Continue to make successional sowings of Beet, Spinach, Carrots, Lettuce, Peas, Radishes, late Broccoli and Kales. Plant out early Leeks, Brussels Sprouts, and Cauliflowers. After the 20th of the month it will be safe to plant Tomatoes out-of-doors. Mustard and Cress will make good progress; they need plenty of moisture, and must be watered in dry weather. Scarlet Runners should be sown during the first week of the month; seedlings raised in boxes in frames should be set out, and staked immediately they are planted.

June.—Continue to sow Dwarf and Runner Beans and make the final sowing of Broad Beans. Transplant the various members of the Cabbage family before they become too large. Make trenches for Celery and Leeks as soon as space used for early Peas and Potatoes is available. In hot weather Turnips, Lettuces, Radishes, and other moisture-loving crops should be sown on a cool border. It will be better to thin Lettuces now than to transplant them. Pull up surplus plants from the rows of Onions and use them as salad.

July.—As soon as early Peas, Beans, and Potatoes have been gathered prepare the ground for Celery, winter Greens, and Cauliflowers. Plant the main crop of Broccoli and sow prickly seeded Spinach to stand through the winter. Of root crops choose the early sorts such as Shorthorn Carrots, Globe Beet, and early White Stone Turnip. Put in a little Parsley seed and thin the plants when they are large enough to handle at 6 inches apart. Remove all the side-shoots from Tomatoes and stake the plants securely.

August.—Make a sowing of Onions about the third week to obtain plants for transplanting in spring. In the first or second week sow seed of spring Cabbages such as Flower of Spring, Ellam's Early, Harbinger, and April. A small sowing of Cabbage may be made at the same time. Sow a hardy dwarf Cabbage Lettuce, Hammersmith or Bath Cos, to stand the winter. Sow winter Spinach and make a final sowing of Turnips. More Celery should be planted early in the month.

September.—Plant vacant ground with all kinds of winter Greens. Endeavour to lift all Potatoes by the end of the month as the ground may get over wet in October and cause many of the tubers to contract disease. Onions should be harvested and dried thoroughly before they are placed in store. Assist the ripening of Tomatoes by removing the foliage where it shades the fruit. Late Cauliflowers should be lifted and transferred to frames where they will receive protection during cold weather. Earth up Celery and Leeks when the soil is in a workable condition.

October.—In fine weather the planting of green crops may be continued. Hardy Lettuces may be pricked out in rows, making the soil firm about the roots. Lift Carrots and Beet before the roots crack through excessive moisture in the soil, and store them in ashes or dry soil under a dry wall. Make a general clearance of the remains of all crops that are finished, burn the rubbish, and get as much of the ground dug as possible before it becomes too wet with autumn rains.

November.—Make Asparagus beds tidy by removing all weeds and rubbish, and apply a surface dressing of rich soil containing plenty of manure. A portion of such hardy crops as Jerusalem Artichokes, Parsnips, and Celery should be lifted when the ground is free from frost, as there may be times when it will be impossible to do this. See that the green crops are not loosened by the action of frost, treading the soil firmly wherever necessary. Clear away all dead leaves from the various greens and keep the crops clear of weeds, to allow the air to circulate freely about the plants.

Endeavour to complete the digging and trenching of all vacant ground so that the soil may receive the beneficial influence of frost.

December.—Whenever the ground is in a suitable condition proceed with tillage operations, as it is an advantage to have

a considerable area of the plot ready for sowing and planting when the New Year arrives. Straighten the path margins and get the plot as neat and tidy as possible.

Prepare stakes, etc., for future use. Think out a plan of operations, selecting the kinds of seeds to be grown and the positions for each, bearing in mind that a change of position is good for all kinds. Arrange Potatoes intended for sets in boxes and place them in a frost-proof shed, where they will be exposed to light.

VEGETABLES AS FOOD

The following lists give the commoner vegetables in the order in which they possess nutrient solids. The most useful varieties to grow for food are thus indicated; in selecting any vegetable, however, the allotment-holder should bear in mind the relative facility of its cultivation, the nature of the soil, and other factors.

The numbers are percentages of nutrient solids, the balance being water. The chief constituents are indicated by the letters M (Mineral Salts), C (Carbohydrates), P (Proteins), and F (Fat).

Pulses

1. Broad Beans (dry)	91.6	MCPF
2. Peas	21.9	MCP
3. French Beans	10.5	MC
4. Scarlet Runners (stewed)	8.9	C

Roots and Tubers

1. Potatoes	21.7	MCP
2. Artichokes (Jerusalem)	20.2	MCPF
3. Parsnips	19.9	MCPF
4. Beetroots	16.1	MC
5. Carrots	14.3	MCF
6. Turnips	9.7	MC
7. Radishes	9.2	MCP

Other Vegetables

1. Kale (Borecole)	17.1	MCPF
2. Savoys	13.0	MC
3. Onions	10.9	MPF
4. Cabbage	10.4	MCPF
5. Red Cabbage	10.0	MCP
6. Cauliflower	9.3	MCPF
7. Leeks	8.2	MCPF
8. Tomatoes	8.1	MCP
9. Celery	6.6	MCP
10. Brussels Sprouts	6.3	MCP
11. Lettuce	5.9	MCPF
12. Rhubarb	5.4	CF
13. Vegetable Marrow	5.2	C

Vitamines

Vitamines are chemical compounds, but little is known of their composition; they are helpful, as they act upon the food previous to or during actual digestion and are thus "intermediate agents" in the digestive processes. They are easily destroyed and therefore easily removed in food preparation. Their absence from foodstuffs is in some way connected with the occurrence of certain diseases—*e.g.* beri-beri and, probably, scurvy. Generally they occur only in minute quantities; but in some food-stuffs—and often in special portions thereof—they are more abundant: *e.g.* in fresh vegetables and in fruit juices; the husk of rice, wheat, and other cereals; the brain and heart of mammals and birds; and in the eggs of birds and in yeasts.

TURNIPS are fleshy roots which contain more water than milk does, only 5 per cent of carbohydrates, and no starch. As a food they are therefore unimportant. The "Swede" is somewhat more nutritious than the usual white variety.

JERUSALEM ARTICHOKES are tubers which contain no starch, but a fair proportion of other carbohydrates, the effect of which is to make the cooked vegetable mucilaginous. Great loss of nutrient substances may occur in cooking; this may be obviated by steaming them in their skins.

POTATOES are an important article of diet, rich in starch. The constituents are distributed very variously in the different parts: the outside layer immediately beneath the brown skin contains most protein, fat, and mineral matter; the flesh contains the most starch; and a narrow, intermediate layer the most water with some protein and mineral matter.

Dextrin and "British" arrowroot are prepared from Potato starch; and Potatoes are also employed in the making of bread with wheat flour. They cannot, however, be regarded as a complete substitute for bread, because they are too bulky a food, and they contain too little protein in proportion to starch.

The method of cooking any vegetable—especially tubers—is all-important. Potatoes should always be steamed or cooked in their "jackets"; they should not be boiled, especially after peeling. Potatoes which are "waxy" when cooked are richer in protein; this is characteristic of "new" Potatoes. The floury varieties are the more digestible.

It has been calculated that if 16 lbs. of

Potatoes were peeled and soaked before being boiled, the loss of nutrients would be nearly equivalent to the amount contained in ¼ lb. of beefsteak.

BEETROOT.—A fleshy root containing a large amount of sugar. Unless great care is taken not to bruise or break the skin, a large proportion of the sugar is lost in cooking. Beetroot is fairly rich in cellulose—and this is rendered softer and more digestible when vinegar is added.

CARROTS are fleshy roots which owe their nutritious value mainly to the sugar they contain; they also contain protein and some quantity of available mineral matter. Hence, although not very digestible, they are a useful food.

PARSNIPS are fleshy roots having 14 per cent of carbohydrates chiefly in the form of starch and sugar; the loss on cooking when peeled bringing the percentage down to 1.4.

GREEN VEGETABLES have a very low nutritive value, but they are of great importance in diet for several reasons. They supply material which acts as a stimulus to the alimentary canal. The mineral matter they contain is largely alkaline and tends to check acidity; and the iron in them is an important source of that substance in the diet. The vitamines are strongly represented; and it is probable that the presence of these constituents largely accounts for the curative powers and wholesomeness of green vegetables. Their poorness in fat leads to their common use with butter, oil, or dripping. Green vegetables are not easily digested or absorbed. They should be eaten as fresh as possible, as otherwise they may set up fermentation. Some, however, may be preserved. CABBAGES contain 89 per cent of water. CAULIFLOWER is the most easily digested. SCARLET RUNNERS and FRENCH BEANS contain much carbohydrate in the form of cellulose—which makes them digested and absorbed with difficulty.

RHUBARB.—A valuable vegetable food, containing a fair amount of carbohydrate, cellulose, and mineral matter.

ONIONS.—An Onion is a bulb, *i.e.* a collection of swollen, overlapping scales completely concealing the central disc-like stem. The oil they contain makes them useful for flavouring. The Spanish Onion is rather more nutritious than the other varieties.

PEAS, BEANS, and **LENTILS.**—The characteristic food constituent of the Pulses is protein, hence their name of "the poor man's beef"; they also have a high percentage of carbohydrate. It is owing to this latter fact that we often find them served with fat-containing foods, *e.g.* pork with pease pudding, bacon with beans.

These foods are highly nutritious. They are slowly digested and very completely absorbed. They are amongst the cheapest of foods, but their poorness in fat necessitates this being supplied from other foods.

As usual with the cooking of vegetables, attention should be paid to details. Dried Peas and Beans should be well soaked with the special object of softening the skins, although this results in some loss of the food-constituents. Hard water should not be used for soaking or cooking. Soft water or boiled water should be used for soaking; or ordinary washing-soda may be added to the water for either purpose.

GREEN PEAS contain a certain amount of their carbohydrate in the form of sugar.

BEANS in general contain more protein than Peas.

LENTILS are still richer in protein—the small varieties being the best; and iron is an important mineral constituent. They are more easily digested than Peas or Beans. Lentils are also used in the form of lentil flour.

FRESH FRUITS.—Considered as articles of food, fruits may be regarded as fruits for flavouring, food fruits, and, to a limited extent, as substitutes for sugar and beverages. OUR HOME-GROWN FRUITS SHOULD HAVE THE PREFERENCE, *e.g.* apples, pears, plums, blackberries.

The chief nutritive constituent is carbohydrate, and three-quarters of the carbohydrates consist of forms of sugar, the remainder being vegetable gums; it is due to these latter that the making of fruit jellies is possible. The mineral constituents are of great value; they chiefly consist of potash combined with various acids, *e.g.* tartaric acid, citric acid, and malic acid. The general effect of the mineral constituents is to render the blood more alkaline. Fruits used for flavouring are of value in assisting and stimulating digestion.

When fruits are cooked, their cellulose is more digestible; but there is always a loss of nutritive constituents unless the juices

are eaten with the fruit (*e.g.* in stewed fruits).

APPLES contain 1 per cent of acids, chiefly malic acid; in this respect they form a strong contrast to PEARS which contain 7 per cent of sugar.

PLUMS contain 1 per cent of protein, which is a high proportion for fresh fruits. They are poor in sugar. APRICOTS, however, have nearly 9 per cent.

CHERRIES contain 10 per cent of sugar.

CURRANTS (WHITE) contain about $6\frac{1}{2}$ per cent of sugar.

GOOSEBERRIES contain $1\frac{1}{2}$ per cent of acids.

TOMATOES are botanically a fruit, though popularly designated a vegetable.

The following sea-borne fruits may be noted, although they are only occasionally obtainable:

LEMONS are rather richer in protein than ORANGES. In sugar percentage lemons stand to oranges almost exactly as plums to apricots.

BANANAS are amongst the most nutritious of fruits.

FRUIT-SUGAR occurs in most fruits, hence the importance of sweet fruits in supplying sugar as a food-substance.

HONEY is a mixture of grape-sugar and fruit-sugar, and therefore is invert sugar; the flavour is derived from substances obtained from the flowers.

DRIED FRUITS, *e.g.* raisins, currants, dates, prunes, and figs, besides their nutritive value, deserve special mention here as sugar-substitutes in puddings, etc. The carbohydrate present is almost entirely sugar (glucoses).

DRIED FIGS are more nutritious than bread; they contain about 50 per cent of sugar and are the richest in protein of the above-named fruits, raisins coming next.

MEDICINAL PLANTS

Cultivation

The prospective grower of medicinal plants must be cautious if the object of growing them is a "commercial" one. The conditions are different from those of growing potatoes, for in respect to this vegetable the object is the development of tubers, the merits of which are judged mainly by the amount of food-matter which they contain. Except when disease makes a failure of the crop there are few blanks, and some degree of success is certain. In the case of medicinal plants, cultivation centres in their capacity for the formation of minute quantities of certain highly complex organic substances which play only a very subordinate rôle in the life of the plant. These substances are in most cases secretory, the production of which it is difficult to control, and cultivators are often obliged to rely on the results of personal and practical experience. This in the case of one kind of medicinal herb does not necessarily help the gardener in cultivating other kinds.

At present there is little on record of actual experience in the cultivation of medicinal plants in this country. Before the war we were importing from the Continent medicinal plants which could have been successfully grown here—in some instances better even than in any country on the Continent. Perhaps it was not worth while, the profits then being small. The position of the matter just before the war may be seen from the following particulars, supplied by the Board of Trade, of the imports of medicinal Trees, Shrubs, Herbs, Flowers, and Roots into the United Kingdom in 1913.

Herbs, Shrubs, and Trees

Germany	£12,313
Netherlands	60,076
Belgium	44,335
France	11,989
Channel Islands	2,742
Other Countries	14,281
	£145,736

Flowers, Roots and Bulbs

Germany	£71,488
Netherlands	385,609
Belgium	21,666
France	32,911
Japan	66,410
United States	3,417
Columbia	1,971
Channel Islands	18,306
British India	2,520
Other Countries	8,279
	613,577
	145,736
	£759,313

It must be borne in mind that since then prices have gone up considerably, especially in the case of some which had become very scarce, and which belonged to the category of vital necessities. If the present prices for medicinal plants had prevailed in 1913 we should be quite safe in estimating their value at £2,000,000.

The cultivation of some medicinal plants in this country is not worth while; still it is a fact that we have not exploited the resources within our reach. For example, the chief source of the Caraway is Holland, although the British variety, on account of its greater intrinsic merits, commands a higher price in our markets. In the following pages the conditions which must be maintained in order to ensure success will be discussed.

Soil and Temperature

Soil.—The chief condition to consider is the nature of the soil, which may be either sandy, clayey, chalky, or peaty. The difference between a sandy and a clayey soil is only one of degree, for, after all, the bulk of a clayey soil is made up of sand-grains, and even in the stiffest Essex soil the stiffening matter it contains does not make up more then 1½ per cent of the total. The chief difference between these two soils from our point of view is that a clayey soil holds more moisture than the sandy kind, and plants

vary in their preferences for the amount of water in the soil. Thus, while Caraway and Coriander grow well in a clayey soil, Foxglove is plentiful only in siliceous soils. Belladonna is found in profusion only in certain well-defined spots on a calcareous soil. A loamy clay may consist of as much as 85 per cent clay, the rest being calcareous matter. This soil, enriched with humus, would serve excellently for the cultivation of Sage. Another clay variation is a sandy loam in which the clay composes up to 40 per cent, the rest being mainly sand. Again, the clay may be mixed with silt—a muddy sand—and constitute another blend. Finally, heath or bog earth may enter into combination with clay, as in the soil on mountain slopes, moors, bog, and marsh lands.

Belladonna, Henbane, and Meadow Saffron have a distinct preference for a calcareous soil. Caraway and Coriander revel in clay, whilst Aconite, Thorn Apple, Opium Poppy, among others, demand plenty of humus for vigorous growth. Speaking generally, it may be stated that soil in good condition which is suitable for growing ordinary crops is suitable for the majority of medicinal plants.

Moisture and Temperature. — These two factors are necessarily bound up with the nature of the soil, for a soil containing much clay retains much more water than one in which clay is absent or present only in a small quantity. Some soils are therefore cold, whilst others are warm. The amount of water held by a soil depends on its capacity to retain the water which it gets from above, and on its power of sucking up the water that is below it in the subsoil. Sand has only a fifth of the retentive power of clay, and only a sixth of that possessed by humus. The power of sucking up water from below finds its highest in the finest clay and its lowest in coarse sand.

Henbane grows luxuriantly on sandy seashores, but Belladonna on the contrary requires far more moisture. Both are essentially calcareous plants, but they differ in respect of the amount of water they require. Such facts as these must be borne in mind in dealing with the prospects of success to be looked for in the cultivation of any particular medicinal plant on any particular soil.

Light.—That there are differences in respect of the amount of light that different plants require to bring out the best that is in them is obvious from a very brief consideration. To take one pair of opposites, it is well known that the Tobacco plant grows very readily in this country, particularly in the south and in Ireland, but it does not produce the best-flavoured tobacco, because the plant needs more sunlight than these climes can give it. It wants all the sunlight that it can get. On the other hand, Foxglove thrives best in shady parts. It must be borne in mind that the effect of light on plants is very complex, and the final result of its influence is the resultant of several forces, some pulling one way, others in other ways. In the case of each medicinal plant the light factor must be kept under consideration in order to ascertain the situations and exposures that are suitable for any particular plant.

Nature is always producing variations, and the aim of the cultivator should be to produce a variety that will elaborate within its cells a greater quantity of the particular substance the presence of which in the plant has been the motive for its cultivation.

Plants of Medicinal Importance

Under this term are included not only these plants which every medical practitioner would regard as indispensable, but also such as are in use as " botanical herbs ". Doubtless many of these possess little value, except perhaps as " faith cures ".

The following list comprises those herbs which are wanted by the hundredweight, in some cases by the ton:—

Agrimony (*Agrimonia Eupatorium*).
Archangel (*Lamium album*).
Avens (*Geum urbanum*).
Betony, Wood (*Stachys Betonica*).
Buckbean (*Menyanthes trifoliata*).
Burdock (*Arctium Lappa*).
Burnet, Greater (*Sanguisorba officinalis*).
Celandine, Greater (*Chelidonium majus*).
Centaury (*Erythræa Centaurium*).
Clivers (*Galium Aparine*).
Comfrey (*Symphytum officinale*).
Dandelion (*Taraxacum officinale*).
Dog's Mercury (*Mercurialis perennis*).
Eyebright (*Euphrasia officinalis*).
Equisetum (*Equisetum arvense*).
Figwort (*Scrophularia nodosa*).
Fumitory (*Fumaria officinalis*).
Ground Ivy (*Glechoma hederacea*).
Hemlock (*Conium maculatum*).
Meadow Sweet (*Spiræa Ulmaria*).
Mountain Flax (*Linum catharticum*).
Mugwort (*Artemisia vulgaris*).
Mullein (*Verbascum Thapsus*).
Ragwort (*Senecio Jacobæa*).
Vervain (*Verbena officinalis*).
Wild Carrot (*Daucus Carota*).
Wood Sage (*Teucrium Scorodonia*).
Yarrow (*Achillea Millefolium*).

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Fig. 201.—Hoeing between rows of Belladonna at the "Wellcome" Materia Medica Farm, Dartford

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Fig. 202.—Gathering Henbane at the "Wellcome" Materia Medica Farm. Dartford

Plants locally abundant and wanted by the cwt.

Belladonna (*Atropa Belladonna*).
Chamomile (*Anthemis nobilis*).
Feverfew (*Chrysanthemum Parthenium*).
Foxglove (*Digitalis purpurea*).
Germander (*Teucrium Chamædrys*).
Marshmallow (*Althæa officinalis*).
Meliiot (*Melilotus officinalis*).
Mother Wort (*Leonurus Cardiaca*).
Pennyroyal (*Mentha Pulegium*).
Peppermint (*Mentha piperita*).
Sundew (*Drosera rotundifolia*).
Tansy (*Tanacetum vulgare*).
Woodruff (*Asperula odorata*).
Wormwood (*Artemisia Absinthium*).

Plants not native but frequently cultivated, and for which there is a ready market in this country

Balm (*Melissa officinalis*)
Basil (*Ocimum Basilicum*).
Hyssop (*Hyssopus officinalis*).
Marjoram, Sweet (*Origanum Majorana*).
Mint (*Mentha viridis*).
Parsley (*Carum Petroselinum*).
Rue (*Ruta graveolens*)
Sage, Red and White (*Salvia officinalis*).
Southernwood (*Artemisia Abrotanum*).
Tarragon (*Artemisia Dracunculus*).
Thyme (*Thymus vulgaris*).
Thyme, Lemon (*Thymus citriodorus*).

Plants whose fruits or seeds are in demand

Angelica (*Archangelica officinalis*).
Burdock (*Arctium Lappa*).
Caraway (*Carum Carvi*).
Celery (*Apium graveolens*).
Colchicum (*Colchicum autumnale*).
Coriander (*Coriandrum sativum*).
Dandelion (*Taraxacum officinale*).
Dill (*Peucedanum graveolens*).
Fennel (*Fœniculum dulce*).
Fenugreek (*Trigonella Fœnum-græcum*).
Flea Seed (*Plantago Psyllium*).
Hemlock (*Conium maculatum*).
Henbane (*Hyoscyamus niger*).
Linseed (*Linum usitatissimum*).
Mawseed (*Papaver somniferum*).
Mustard, Black (*Brassica nigra*).
Mustard, White (*Brassica alba*).
Stramonium (*Datura Stramonium*).

Plants whose roots are in demand

Bistort (*Polygonum Bistorta*).
Bryony, Black (*Tamus communis*).
Burnet (*Pimpinella Saxifraga*).
Butterbur (*Petasites vulgaris*).
Calamus (*Acorus Calamus*).
Colchicum (*Colchicum autumnale*).
Couch Grass (*Agropyrum repens*).
Dock, (Red) (*Rumex aquaticus*).
Dock, Yellow (*Rumex crispus*).
Elecampane (*Inula Helenium*).
Gladwin (*Iris fœtidissima*).
Horseradish (*Cochlearia Armoracia*).
Lovage (*Levisticum officinale*).
Male Fern (*Dryopteris Filix-mas*).
Polypody (*Polypodium vulgare*).
Tormentil (*Potentilla tormentilla*).

It is not expedient to deal here with every plant that has at some time or other been of reputed medicinal value, and only the more important which are worth cultivating are included in the following selection:—

ACONITE (*Aconitum Napellus*) (fig. 203). —This plant grows wild in the West of England and in South Wales, where it prefers shady places. It does best in a soil that is slightly retentive of moisture, and in the drug farms the moist loam of Ampthill and the dark soil of Market Deeping have proved very suitable.

Good loam is a happy blend of clay and sand well enriched with vegetable residues, and Aconite undoubtedly grows best in a soil in which these three constituents are fairly balanced. The soil is all the better for being shaded, and should be well dug in time to get pulverized by early winter

Fig. 203.—Aconite (*Aconitum Napellus*)

frosts. In addition, the digging in of rotted leaves or stable manure is recommended. Aconite is usually propagated from the smaller roots which develop at the sides of the old ones. After the stem has died down the plants are dug up in autumn, the larger roots being washed, split, and dried. These form the Aconite root of commerce. Replanting of the daughter roots is done in December or January, these being placed a foot apart each way. The young shoots appear above ground in February or March. Care should be taken in the selection of the particular variety that is to be cultivated, for there are altogether nearly fifty different forms of this plant, and it is known that the active principle may vary so much in the different samples that it is possible for one sample to contain seventy times as much of the active principle as another. It would be worth while to make experimental trials with the different varieties in order to obtain the best.

DEADLY NIGHTSHADE (*Atropa Belladonna*) (fig. 204).—A supply of this plant is a vital necessity.

Formerly we imported the drug from South Hungary. The plant, however, occurs wild in Britain, growing luxuriantly in chalk, limestone, and oolitic soils. It therefore requires a calcareous soil, and in nature it is found growing most luxuriantly under the shade of trees. It also occurs in the open, in old quarries for example, but in such situations it assumes a more stunted appearance. The essentials for its successful growth are: calcareous soil, sufficient shade, good drainage.

The seeds are sown in spring, being drilled in rows 3 feet apart, about 2 to 3 lb. of seed being used to the acre. It is customary to grow a reserve of plants in seed beds to take the place of seeds that have not germinated or of seedlings that have been killed by frost. To safeguard the seedlings against frost it is recommended that a light dressing of farmyard manure be placed on the top to ensure the seedlings against extremes of temperature. Great care must also be taken to keep the crop clean in spring. During the first year the plants are kept about 18 inches apart, and by September they should be from 1½ to 2 feet high. At this time a gathering of leaves may be made, a "leaf", in this case meaning the broken-off top of the plant. The coarser stems are left on the plant, and of course discoloured stems are rejected. During late autumn the plants should be thinned to 2½ to 3 feet apart. The crop is cut in the second year with

Fig. 204.—Deadly Nightshade (*Atropa Belladonna*)
1, Corolla opened. 2, Pistil. 3, Fruit. 4, Section of fruit.

sickles, and is usually sent straight to the factory. Expedition is necessary in this case, as the plants must reach the factory before "heating" takes place, which renders them useless. In September a second crop is obtained in good seasons. In the fourth year the root is dug up in autumn washed, and sliced to accelerate drying.

Foxglove (*Digitalis purpurea*) (fig. 205).—Cultivated in the partial shade of orchards, but requires a moderate amount of sun. It grows best in a well-drained, loose soil, rich in leaf mould. About 2 lb. of seed are required per acre. As the seeds are very small they should be mixed with sand to secure an even distribution. The

Fig. 205.—Foxglove (*Digitalis purpurea*)

leaves are hand picked in the second year from flowering plants, from 1 to 2 tons being a good yield per acre. The leaves must be dried quickly.

It is doubtful how far the cultivation of Foxglove is remunerative. Dry wild leaves are worth about 35*s*. a cwt., and the few growers that cultivate Foxglove do so for a limited market in order to provide a drug of uniform activity. For this purpose it is, of course, necessary that cultivation should be effected from a fixed type.

Colchicum or Meadow Saffron (*Colchicum autumnale*) (fig. 206).—Abundant in damp meadows in the west of England It can be grown in damp soil, which should be of a calcareous nature to obtain the best results. The dried corms and seeds supply a valuable drug. The corms should be dug in summer, peeled, sliced, and dried. The capsules containing the seeds should be cut off when they are just beginning to split, and hung in muslin bags in a dry place until the seeds are dry enough to shake out. The seeds must not be washed.

During the war the price of Colchicum corms rose from 4*d*. a lb. to about 4*s*. 6*d*. a lb., a sure indication of the value set on them for medicinal purposes.

The four plants described as above are, according to the Board of Agriculture, really essential,

and at all times provision must be made for the maintenance of their supply. The question, however, as to which medicinal plants are worth cultivating for the sake of the return they are likely to bring is a much wider one. It is a question of determining which plants have hitherto been imported into this country and can quite as readily be grown within our own shores. We can easily estimate this from a consideration of the plants of a medicinal or sub-medicinal nature that were actually imported before the war.

Fig. 206.—*Colchicum autumnale*

Caraway (*Carum Carvi*) (fig. 69).—This plant grows best in water-holding clayey soils. It is cultivated in Iceland, the Himalayas, the north of Scotland, and even in Arctic Russia, as well as in the more southerly regions of Europe, particularly Germany and Holland. Most of our supply comes from the latter country, and this in spite of the fact that the English variety fetches the highest price. The fruit contains 3½ to 6½ per cent of volatile oil, which is valuable as a stimulant. In Holland some 20,000 acres are devoted to this crop, each acre yielding about 1000 lb. The plant is a biennial, hence it is necessary to grow some annual crop in conjunction with it. Usually Coriander is chosen for this purpose. It is harvested early in July, being cut with a sickle at about a foot from the ground, and left to ripen before being threshed.

With intensive cultivation there is scope for a better yield than that which has hitherto been obtained. In Holland, which has practically a world monopoly in the cultivation of Caraway, old grass land is broken up for the purpose.

Dill (*Peucedanum*).—Although a native of more southern climes, Dill can be successfully cultivated in this country, for it is cultivated even as far north as Frondhjem, in Norway. The seed is sown in March in furrows on clean land in good condition, any friable garden soil in an open situation being suitable. The seeds are sown in drills 1 inch apart, and the seedlings thinned to 10 inches apart; 10 lb. of seed should be drilled to the acre, which should yield 6 cwt. of fruit. The plants do not all ripen simultaneously, and the fruits, when mature, fall off very easily. The umbels are therefore cut off close to their base when the fruits are fully formed but before they are quite ripe. If it is desired to collect the seed, the plant is cut off near the ground when the seeds begin to assume a brown colour. After lying on the ground for a few days, the seeds are separated from the plants by sifting, the ripest being kept for sowing, the remainder distilled. Dill, as a rotation crop, does remarkably well after Beans.

Coriander (*Coriandrum sativum*).—An Umbelliferous annual found wild as a weed of cultivation in some of the southern and eastern counties. It grows on ordinary soils, and is recommended for cultivation in small holdings. The seeds are sown in warm positions in spring and autumn. Before the war we imported Coriander from Bombay, Morocco, Russia and Germany. Its price in 1914, from 16*s*. to 30*s*. per cwt.

Fennel (*Fœniculum capillaceum*).—This plant is adapted to dry and stony situations and likes plenty of sun, yielding the best results on a rich soil with some admixture of clay. From 4½ to 5 lb. of seed are sown per acre in the spring, and a crop of 15 cwt. per acre should be obtained. The cutting of the plants is done before the fruits are fully ripe. German fennel used to sell at about 35*s*. per cwt., so there should be no difficulty in getting a good return for a home-grown supply. It should be mentioned that the British varieties are not the best in the market, but there is little doubt that after some experience we could improve the quality, for much variability is exhibited in those physiological properties which determine the value of the plant.

Aniseed (*Pimpinella*).—A native of southern and central Europe, cultivated in Germany, and to a small extent in Scotland. It flourishes best in a light, sandy soil. As our own consumption is 100 tons per annum, it should be cultivated here. It is raised from seeds sown in April on a southern exposure in lines 1 foot apart. The seedlings are afterwards thinned to 6 inches in the line. In 1913 Russian aniseed fetched 24*s*. per cwt., in 1917, 56*s*. Within the limits of the same years the price of Spanish aniseed rose from 28*s*. to 100*s*.

Chamomile Flowers (*Anthemis nobilis*).—A native of this country, also cultivated here as well as in Belgium, France, and other countries. Owing to the war the price rose from 55*s*. to 140*s*. per cwt. English-grown Chamomile is dearer than Belgian, fetching about 3*s*. per lb. more. The extended cultivation of this plant should therefore receive attention. It grows best in stiff, black loam. In March each old plant is divided into ten or twelve portions, and these are planted in rows 2½ feet apart, with a distance of 18 inches between the plants in a row. The flowers are picked in September and rapidly dried on canvas

trays in a heated drying-closet. From 5 to 6 lb. of fresh flowers yield 1 lb. of dry flowers, and 1 acre should yield about 4 cwt.

Opium Poppy (*Papaver somniferum*) (fig. 207). — Poppies grow well in a rich, moist soil with plenty of sun. It is customary to crop them after Wheat, Oats, or Barley. After manuring and ploughing in autumn, the seed is sown in March or April, at the rate of 1 lb. per acre. The drills are made 1 foot apart. When 3 to 4 inches high the plants are cut into clumps 6 to 9 inches apart, and then all except one are removed from the clump. If needed, a dressing of soot or some fertilizer is applied. There is a steady market for Poppy heads in this country, the capsules being harvested about

Fig. 207.—Opium Poppy (*Papaver somniferum*)

1, Capsule showing Turkish method of incision to get opium. 2, Seed. 3, Section of seed.

September and placed for a fortnight to dry on a boarded floor in a freely ventilated building. They are placed in a thin layer, and are turned every day to secure uniformity of drying. They are regarded as being ready when they have become brittle and crack in the hand when pressed. The price of the larger heads is 12*s.* to 15*s.* per 1000, of the smaller size 8*s.* to 10*s.* per 1000. The common Poppy head of the pharmacist is grown in Lincolnshire.

Peppermint (*Mentha piperita*).—Before the war 40,000 cwt. of this plant was imported from one district alone in Germany, and this in spite of the fact that the British variety is of better quality than the Continental. The decline of the British variety was due to its higher price. The cultivation of Peppermint at the present time promises well. The plant grows in any ordinary good moist soil. It is propagated by division of roots, or by cuttings in autumn or early spring.

Lavender (*Lavandula Spica*).—English-grown lavender oil is worth five to ten times as much as the French product. This is an example of a plant which, although not British, can be grown more successfully in Britain than in its more southern native climes. It grows best on a poor, sandy soil containing lime, and should never be planted on low wet ground. Early in the spring the young plants or cuttings are set in the soil, 12 to 15 inches apart in rows. In the first year there will not be many flower spikes, but in each of the three following years a good crop may be expected. The spikes should be picked when the lowermost flowers are opening, the flowers being then removed from the stalks and dried. Propagated from cuttings rather than from seed.

Thorn-apple (*Datura Stramonium*). — The leaves of this plant are imported from Hungary and Germany. It is an attractive garden plant, and at the same time its seeds and leaves have a commercial value. It is an annual and grows readily from seed. Under cultivation it thrives best in rich and rather heavy soils, to which a fair sprinkling of lime has been added. The seeds should be sown in spring in drills about 3 feet apart, and just barely covered. The seedlings should be thinned to 12 to 15 inches apart in the row. The leaves are collected when the plants are in full bloom, and dried at a temperature of 100° F. to 110° F. The yield of dry leaves is 1000 to 1500 lb. per acre. The seeds are gathered in the autumn when they are mature but still somewhat green. The capsules are dried for a few days, when they burst open of their own accord, and the seeds are easily shaken out. The yield is variable, and runs from 500 lb. to 2000 lb. of seed per acre.

Valerian (*Valeriana officinalis*). — One must beware of the ornamental plant often called Valerian, which is *Centranthis ruber*, and has no medicinal value. Some of the drug Valerian in commerce comes from Derbyshire, but before the war a good deal was imported from Holland, Germany, and France. The British root is the more valuable, fetching about four times as much as foreign. In Derbyshire, cultivation is by the transplantation to prepared soil of wild plants gathered in the local woods. The young flowering plants develop at the end of slender runners. These are planted on soil treated with farmyard manure. It is advantageous to give plenty of liquid manure, also artificial manure from time to time. As only the underground part is collected, the flowering tops are cut off in order to encourage the growth of the part underground. In September or October the tops are cut off with a scythe, and the roots dug up, sliced longitudinally, washed, and dried on a shed floor about 6 feet above the ground. The wet material is strewn on perforated boards below which a large coke oven is kept going until the drying is complete. About 24 lb. of the dry product are obtained from 100 lb. of fresh. Derbyshire Valerian is of two species, namely, *V. Mickanii* on limestone, and *V. sambucifolia* on the coal measures, the former being most cultivated.

Methods of Drying

Success in the cultivation of medicinal herbs depends largely on carefulness in drying. It is not possible to lay down exact rules for each herb, but a few general remarks will be useful as a guide.

1. The majority of plants lose over 70 per

cent of moisture, and some even up to 90 per cent during the operation of drying.

2. After they are dried, most plants absorb some 12 per cent of moisture from the atmosphere.

3. A high temperature is to be avoided. We must therefore select or construct a place in which there is plenty of ventilation, so as to permit a good circulation of air, and if artificial heat is available, so much the better. The plants can be exposed to the sun during the day but must be under cover during wet weather and at night. The method adopted in the Hungarian forests is drying in wooden sheds, which are divided into shelves by trays made of wire netting tacked on wooden frames. Heat is supplied by coke fires, and ventilation by the drilling of small holes in the wall near the roof. Drying can be conducted in glass houses, especially if these are heated by hot-water pipes. A good average temperature is about 100° F. Some distinction must be made between the different kinds of plants. Plants with a fairly stout stem, which includes most of the ordinary herbs, can be tied up in loose bundles and suspended in a convenient place. Plants that are flaccid should be laid on trays and freely exposed. They should be turned over periodically and covered on the first suggestion of rain—also during the night.

All dead or discoloured portions should be removed from drying plants. If heat be applied it should never be such as will cause the leaves to turn brown and shrivel. The exact temperature at which the best results are obtained is a matter of experience, but it may be stated that as in the majority of cases the substance to be preserved is easily decomposed, and the chief factors which are liable to create an organic change in the constitution of this substance, rendering it worthless, are light, heat, and moisture, therefore an ideal drying apparatus would be one which removed the moisture in the dark at a comparatively low temperature. There may be cases in which the exposure to light is beneficial. Some day, perhaps, the Board of Agriculture will set research workers at these problems, who should be able to furnish, in the case of each plant, specific instructions based on experimental work on the nature of the alkaloidal and other substances that give value to medicinal plants. Speaking generally, a low temperature—well below 100° F. — should be employed for tender parts, such as leaves and flowers, but higher temperatures—about 100° F.— should be used when tougher parts, such as rhizomes, barks, and roots are to be dried.

Collecting

Medicinal plants should be collected only in dry weather, preferably when the sun is warm and when there is no dew on them. A little discrimination is needed in collecting the different parts of the plant. Roots are necessarily most active just when fully formed, as they contain then most of the active principle which gives value to them. In spring the condition of the root is much the same as in autumn. The development of the shoot makes a marked difference in the constitution of the root, the difference being unfavourable for the purpose of the herb-grower. The " capital " must be drawn from before it has been invested in the formation of new shoots.

Leaves must be caught in their prime, neither too young nor too old. The leaf is the chief laboratory of the plant, and there is more of any particular substance when it is in full swing than when it is just beginning to work, as in the case of a young leaf, or when it is about finished at the end of the season. The leaves should therefore be collected about the time when the flowers are beginning to appear.

Flowers are generally picked just before they open. In most cases when they grow on a spike they do not open simultaneously. They should therefore be picked day by day as they reach the proper stage. Flowers must not be allowed to get discoloured by heat.

Packing

After drying it is essential to protect the herbs from the re-absorption of moisture from the air. They must therefore be kept in biscuit-tins or other air-tight receptacles. For most herbs consignment in sacks answers, but in the case of leaves like Foxglove, Belladonna, &c., they should be carefully placed in layers in air-tight boxes before consignment. Cardboard dress-boxes have the merit of being light, and could be used for some kinds.

VEGETABLES FOR EXHIBITION

To grow vegetables for exhibition to compete for prizes special conditions and superior skill are necessary to obtain the best possible results. Its educative effect is great, as the grower becomes more and more intent on learning all there is to be known about the nature of soils, the values of manures, and all the other factors which influence the growth of plants.

Select positions in the garden should be reserved for the purpose, so that it will be possible to give the special treatment required to ensure success. The beginner may not have sufficient confidence in his knowledge of his crops and their requirements, and will probably desire to grow a considerable quantity of each, so that he may have plenty to select his exhibits from; but, as he gains more experience, he will find that with a smaller number of plants he will be able to give them more attention and get much better results. Sometimes the gardener who exhibits at vegetable shows, cultivates the whole of his crops as well as possible, and then makes a selection for the show; but, when this is done, he may have to hold up all his crops until after the selection is made.

The Potato.—The object to aim at in growing Potatoes for exhibition is to secure tubers with shallow eyes, clear skin, and of fair size. A class for heaviest tubers is sometimes included in the schedule of the show, when size alone counts; but as such large tubers are frequently very coarse, this class should not be encouraged. The best varieties only should be grown for exhibition purposes. The tubers should be carefully selected, and placed in boxes for sprouting in the ordinary way.

Planting.—A compost should be prepared as follows: 5 parts of chopped loam (turf, which has lain for a year to rot), 1 part leaf-mould (decayed leaves), 1 part well-rotted horse manure, 1 part wood ashes, a little sand, a 6-inch potful of bone meal per barrow-load of the compost.

Turn the compost two or three times to mix it thoroughly.

The ground having been well cultivated, make deep drills, 3 feet apart, and place two bucketfuls of the compost at intervals of 2 to 3 feet apart in the drills. Place a tuber in the centre of each small mound of the compost, and pull up the soil on each side of the mounds, leaving the ground in ridges. As soon as the plants appear above the soil, the surface should be broken up with the hoe to destroy the weeds, and to aerate the soil. The usual precautions should be taken against attacks of disease.

Good exhibition varieties are: Edzell Blue, Arran Comrade, Ally, White City, Kerr's Pink, Majestic, and Golden Wonder.

Artichokes (Jerusalem).—The tubers should be of medium size, unbranched, and clear skinned.

Any ordinary garden soil will grow Artichokes. As soon as the soil is sufficiently dry in March, the tubers should be planted singly 18 inches apart, in rows 3 feet apart.

No further attention is necessary until the tubers are ready for lifting.

Varieties: Sutton's White, Sutton's Rose.

Artichokes (Globe).—Large flower heads, well-shaped, with fleshy, well-closed scales.

The soil must be light and well drained, and it should be trenched and well manured in the autumn. In April or May strong, well-rooted suckers should be obtained and planted in clumps of three, 3 feet apart. Give plenty of water throughout the season. When the flower heads are forming, give occasional supplies of dilute liquid manure. To obtain the finest specimens, allow one head only on each plant.

In November, place rough straw manure round the plants to protect them from frost.

Varieties: Green Globe, Purple Globe.

Carrots.—These, for exhibition, should be fine-coloured, well-shaped roots. The

best seed is that which has been saved from the finest selected roots. The soil should be well and deeply cultivated, especially for the long varieties. Sow the seeds in rows 15 inches apart. Holes 3 feet deep should be made with a crowbar for the long varieties, and 1 foot deep for the short varieties, 6 to 9 inches apart. A compost should be made up as follows: 3 parts sifted loam, 1 part leaf-mould, 1 part wood ashes, ½ part of sand, a very small amount of well-rotted manure.

These should be well mixed, and the holes then filled with the compost; leave for twenty-four hours to settle down, and sow three or four seeds in the top of each hole, and covering with an inch of the compost. Care should be taken to prevent the carrot fly from attacking the roots.

Varieties: Champion Scarlet Horn, Sutton's Early Gem, Selected Intermediate, Selected Altringham.

Beetroot.—Quality rather than size is required in exhibition Beetroot. The flesh should be dark in colour and free from stringiness; they should be of good shape, dark in colour, and not have many rootlets.

Sow the seeds in a compost similar to that used for exhibition Carrots in rows 18 inches apart. Holes should be made with a crowbar, 2 feet deep, and 9 inches apart, and filled with the compost. Three or four seeds should be sown in the centre of the top of each hole, and covered with 1½ inches of the compost. When the plants are about 1½ inches high they should be thinned, leaving in each hole the plant with the finest and darkest coloured foliage, as this indicates the finer quality of root. Care should be taken to prevent attacks of the leaf miner.

Varieties: Dobbie's Selected Purple, Sutton's Blood Red, Selected Globe.

Parsnips.—Size and form of root are the objects to be aimed at in exhibition Parsnips. They require as long a season as possible to complete their growth. In the north on heavy soil, it is difficult to get the ground in the proper condition early enough to ensure a long season of growth. To overcome this to some extent, the soil should be cultivated deeply and thrown up roughly 18 inches to 2 feet above the level of the surrounding soil; this will enable it to become warmed and to dry up sooner. The seed should be sown in rows 18 inches apart, and holes made 3 feet deep and 9 inches apart; make up the compost as for Carrots, but it should include 1 part of well-rotted horse manure. Fill the holes, leaving the soil to settle for twenty-four hours, and then sow three or four seeds in the centre of the top of each hole, and cover with 1½ inches of the compost. Thin out the plants when they are about 1½ inches high, leaving the largest nearest the centre of the hole. Prevent the rust disease or leaf miner from attacking the crop.

Varieties: Dobbie's Selected, Tender and True.

Turnips.—Medium-sized roots of good shape and colour, and with solid crisp and juicy flesh, are desired in exhibition Turnips. To obtain these, the time of sowing must be carefully chosen (according to the district). Early varieties, such as Snowball, take from six weeks on light soil to eight weeks on heavy soil. Later varieties, such as Golden Ball, take from eight weeks on light soils to ten weeks on heavy soils to develop. The soil should be well cultivated, and fairly heavily manured. The time of sowing must be carefully chosen, according to the date of the show, the soil (heavy or light), the district (early or late), and the variety to be grown. Prevent attacks of insect pests and disease.

Varieties: Dobbie's Selected Model White, Sutton's Early Snowball, Selected Golden Ball, Selected Red Globe.

Cabbages.—Medium size (except for heaviest Cabbage class), firm heart, and freshness in appearance are the principal points to aim at. The soil should be well cultivated and heavily manured. The seed may be sown in July or August, or in March or April, and the seedlings planted in March and in June. The soil should be trodden firmly along the line before planting, to induce slow growth and the formation of a solid heart. On light soil a mulching of 3 inches of rotted manure keeps it cool and moist, and ensures continuous healthy growth.

Precautions must be taken against insect pests and disease.

Varieties: Sutton's All Heart, Improved Winningstadt, Selected Drumhead, Selected Red.

Savoys.—The cultural directions for these are the same as for Cabbages.

Varieties: Selected Green Curled, Perfection, Selected Drumhead.

Brussels Sprouts.—Straight stems and abundance of medium-sized firm Sprouts are the points desired in Brussels Sprouts. General cultivation as for Cabbage. To

afford the plants plenty of room to develop, set them 3 feet apart each way.

Varieties: Dobbie's Selected, Sutton's Exhibition.

Kale.—General cultivation as for Cabbage. Large plants with well-balanced growth of leaves, finely curled, and crisp to the touch are needed. The centre of the plant must be well filled with young, finely curled leaves.

Variety: Dobbie's Victoria.

Cauliflowers. — Good form, compact heads, pure white, and of fair size are the qualities required in exhibition cauliflowers. The heads will not remain in good condition for many days, hence sowing the seed and planting must be carefully timed, to secure perfect heads for a certain date. The time required for cauliflowers to reach maturity varies with the nature of the soil, and with the season. From four and a half to five months for early varieties, and from five to six months for later varieties. A second sowing should be made a fortnight later. The soil must be thoroughly and deeply cultivated and heavily manured.

The seed may be sown in a flower-pot in February (late varieties) and outside in April for early varieties, transplanting being done in May and June. Early varieties should be planted 2 feet apart each way, late varieties 2 feet 6 inches apart each way. Throw out "blind" seedlings. On light soils a good mulching of rotted manure should be given if the weather is dry, to ensure continuous and succulent growth. In sunny weather the leaves should be doubled over the heads, to prevent their turning yellow by exposure. A good soaking of liquid manure may be given once a fortnight if the soil is light or poor.

Varieties: Sutton's Magnum Bonum, Sutton's Early Giant, Dobbie's Excelsior, Sutton's Autumn Mammoth, Veitch's Autumn Giant.

Asparagus.—The qualities required in exhibition Asparagus are thick, succulent stems, with short, closed scales.

A rich, well-drained, and deeply cultivated soil is necessary. To start a new bed, the ground should be prepared in autumn by trenching the soil to 3 feet deep, adding manure between each spit of soil; the surface may be left in ridges, rough throughout the winter. Planting should be done the following April, setting strong seedlings a foot apart in rows, allowing 18 inches between the rows. Another way is to plant in single rows 2 feet apart, and 18 inches between the plants in the rows.

No stems should be removed before the third year after planting. The soil should meanwhile be kept in good tilth and free from weeds. If the beds are top dressed with cow manure each year and occasionally watered with liquid manure, the plants will become strong and produce good supplies of fat stems for years.

Cutting may begin each year as soon as the young shoots appear above the ground. No cutting should be done after the middle of June.

The finest Asparagus is obtained from comparatively young crowns, therefore where this vegetable is required for exhibition purposes a new plantation should be made periodically.

Varieties: Sutton's Perfection, Sutton's Giant French.

Peas.—This excellent vegetable requires careful treatment to get it in perfect condition for a show on a fixed date. Large pods, fresh and well filled with large peas of good colour and of fine flavour, are to be aimed at. Peas do not remain in good condition long; hence the time of sowing must be carefully considered. It takes about four months from the time of sowing for the pods to mature; but this varies according to the season and the situation. An excellent compost for exhibition peas is as follows: 6 parts chopped loam, 1 part leaf-mould, 1 part wood ashes, 1 part well-rotted horse manure, a 6-inch potful of bone meal per barrow-load of the compost.

These should be thoroughly mixed and then placed in trenches 1 foot deep.

A flat drill 3 inches deep should then be drawn in the compost, the seeds placed 4 inches apart each way over the bottom of the broad drill, and covered with 3 inches of the compost. Staking should be attended to in time to prevent the plants getting twisted or broken, which would check their growth.

When the plants have produced three or four pairs of pods, some of which will be at the proper stage of development at the show time, the tops may be nipped out, thus encouraging the pods already formed to develop to their full extent. If the first pods formed are too early, they may be removed as soon as they are ready for use; this will help the development of those which are left.

This may seem wasteful, but, though there will be fewer pods, each will be filled with large Peas.

Varieties: Duchess of York, Prizewinner, Dobbie's Selected Alderman, The V.C., Peerless, Sutton's Exhibition.

Broad Beans.—Large, shapely pods, well filled with large and tender Beans, are desired. The time of sowing must be carefully chosen. It takes about five months for the Beans to develop to the proper stage. The soil should be well dug and manured, and a dressing given of superphosphate, 4 lb. per pole, and of sulphate of potash, 1½ lb. per pole. Sow the seed in double rows 1 foot apart, and alternately. Give a good mulching of fresh manure before dry weather sets in, to keep the plants growing and to ensure the production of large pods; this also helps to keep off the attack of black fly.

Varieties: Mammoth Longpod, Exhibition Longpod, Giant Windsor, Selected Broad Windsor.

French Beans.—Long, crisp pods of good shape are to be aimed at.

The time of sowing to get the crop in condition at the proper time is specially necessary. The crop takes from three to four months to come to proper condition. The soil must be well cultivated, moderately manured, and dressed with 5 lb. of superphosphate and 1½ lb. of sulphate of potash per pole.

The seed should be sown, two together, in drills 18 inches apart, and 1 foot between the pairs of seed in the drills, one plant being removed if both grow. A mulching of rotted manure should be given if the soil is light.

Varieties: Magnum Bonum, Selected Canadian Wonder.

Runner Beans.—Long, straight, well-formed pods, crisp and fleshy, are the chief points to be aimed at. A compost should be made up as follows: 6 parts chopped loam, 1 part leaf-mould, 1 part wood ashes, 1 part well-decayed horse manure, a 6-inch potful of bone meal per barrow-load of the compost. A trench 18 inches deep should then be made. Break up the soil in the bottom of the trench, and fill it with the compost. The time of sowing should be chosen so as to have pods in the proper condition at the time of the show. Sow in double rows, 1 foot between, and the seeds 1 foot apart in the rows, and cover with 3 inches of compost.

It takes about four months for this crop to develop.

Staking.—As soon as the plants are up, a single bamboo stake should be fixed beside each plant, leaving 8 to 9 feet above the ground. Cross the opposite pieces of stakes at the top, and lay one along between the crossed upright ones, tying each pair to the one lying along the top. This will prevent the stakes and plants being blown about by the wind. In hot seasons, and on light soils, a mulching of rough manure should be given.

Varieties: Champion Scarlet Runner, Prizewinner, Best of All.

Tomato.—Fruit of medium size with clear, smooth skin, and firm flesh are required for exhibition.

Sow the seed in February in a compost of 2 parts of sifted loam, 1 part leaf-mould, and a little sand, and place in a temperature of 60°. When the little plants have made two rough leaves, pot them singly in 3-inch pots, using a similar compost, and place on a shelf near the glass. They may either remain in these pots until ready for potting into large pots, or planting in a border, or they may be allowed another shift into 6-inch pots. Do not plant young Tomatoes in a rich compost, as it causes rank growth. If intended to fruit in pots, the plants should be potted again into 12-inch pots, which should be well drained; using a mixture of 6 parts fibrous loam, 1 part leaf-mould, 1 part well-rotted manure, a good sprinkling of wood ashes and sand, with a 5-inch potful of bone meal to each bushel of soil. When potting, it is advisable to only half fill the pots with soil, the other part being added when the plants have made considerable growth. The soil must be made firm with a potting stick. When watering the plants, give enough water to thoroughly saturate the whole of the soil. When a few trusses of fruit have set on each plant, liquid manure may be given freely to assist in swelling the fruit. All side shoots must be removed as they appear.

Plants grown in the borders in a greenhouse should be planted 2 feet apart in the row and 2 feet between the rows. The soil must not be too rich; but at planting time a top dressing of 3 ounces of super-phosphate and 1½ ounces of sulphate of potash per square yard should be raked into it. Careful watering is necessary. A fortnight or so before the show, the finest fruits should be selected, and if they are shaded with leaves

remove them, to ensure the fruits being well matured and uniformly coloured. Defoliation should not be carried to excess, as it prevents proper ripening and reduces greatly the quality of the fruit.

Varieties: Sutton's Best of All, Kerr's Excelsior, Bountiful.

Cucumber.—Young tender fruits, uniform in thickness, dark green, and short-necked, are desired for exhibition.

The finest fruits are obtained from young plants which are in fruit when about three months old. Sow the seed singly in thumb pots in fibrous loam, in a house with a temperature of 70°. Repot into 5-inch pots before the plants become pot bound.

For greenhouse culture use a compost of 4 parts fibrous loam, 1 part fibrous peat, and 1 part well-rotted manure. Place about a bushel of the compost on slate staging immediately over the hot-water pipes, and put a plant in the centre of each mound, allowing about 3 feet between the plants. Keep the temperature of the house at 70°, rising to 80° on bright days. Syringe the house morning and afternoon. As the young roots appear on the surface of the soil, add more of the same compost until the bed is level. Give plenty of water at the root as it is required.

A stake should be placed against each plant, and the main shoot tied to this. As soon as the leader reaches above the wires of the house, the top should be pinched out to induce the formation of laterals. When the fruit appears, the top of the shoot should be pinched out one joint above the fruit, when the fruit will swell rapidly, and another shoot will be produced from the axile of the leaf. This in turn will produce a fruit; the point of this shoot should again be pinched out as before. In this way fruit will be formed in succession for a considerable period. Superfluous shoots should be pinched out to prevent overcrowding, and if too many fruits are formed some of them should be removed. When the plants are bearing freely, liquid manure must be given frequently.

Frame Culture.—Make a hotbed of fresh, strawy horse manure and partially decayed leaves, building it up into a square heap and placing a frame on the top of it. Tread the bed firmly to ensure slow fermentation and the production of continuous heat over a long period. Cover the surface with 6 inches of soil, to prevent the ammonia which will be given off scorching the plants.

Place about a bushel of the same compost as advised for greenhouse culture in the centre of the frame, or in the centre of each light of a larger frame, and place a plant in the centre of each.

The frame should be damped down morning and early afternoon every day. Air must be admitted cautiously in the early season, and the frame must always be closed early in the afternoon to conserve the sun-heat.

The further treatment of the plants may be carried out as advised for greenhouse Cucumbers. Pinch out the point of the main shoot to produce laterals, pinching the laterals at a leaf past the fruit, and removing superfluous laterals and fruits to prevent overcrowding and overcropping. More soil may be added to the mound as required, and liquid manure given as the fruit begins to grow.

Cucumber fruits grown in a frame are apt to curl; to prevent this a narrow box without ends or top should be placed below the most promising fruits; this will cause them to grow quite straight.

Varieties: Sutton's A1, Austin's Improved Telegraph.

Vegetable Marrows.—Fruits of medium size, uniform in shape, fresh, and tender are preferred for exhibition.

Sow the seed in March singly in thumb pots in loam, and place in gentle bottom-heat. When the plants have made considerable growth, repot into 4-inch pots, and gradually harden them off for planting out in May or June on mounds of fresh horse manure, trodden down firm and topped with 6 inches of loamy soil. Two plants may be set on each mound. A handlight should be placed over the plants during cold nights for some time after planting. Plenty of water must be given during dry weather.

No pinching or training is necessary for Vegetable Marrows, but, as the date of the show approaches, a few of the most suitable fruits should be selected, and some of the others removed to ensure the finest specimens being obtained at the time of the show.

Varieties: Sutton's Vegetable Marrow, Sutton's Perfection.

Egg Plant.—This plant is not commonly cultivated in this country, but is extensively grown in France and Italy. It is grown for its fine ornamental fruits, which are used as a vegetable.

Perfect shape and bright colour are the qualities aimed at for exhibition.

Seed should be sown in February in a compost of 3 parts loam, 1 part leaf-mould, ½ part well-rotted manure, and a sprinkling of sand, in a temperature of 65°. As soon as the plants are large enough they should be set singly in 4-inch pots, and later into 8-inch pots. Water freely, and when the fruit is forming give liquid manure.

If grown for exhibition, each plant should carry only one fruit, but it is usual to allow four fruits on each plant.

Varieties: Sutton's Long Purple, New York Purple, White.

Onions. — Large solid bulbs of good shape, with thin neck and clear skin, are the chief points in exhibition Onions.

The soil must be as deeply cultivated as its depth will allow. If possible it should be trenched three spits deep; but the subsoil must on no account be brought to the surface. Manure heavily with well-rotted farmyard manure, placing a good layer between every two spits as the soil is trenched. A good sprinkling of soot should be raked into the soil also before planting. The seed should be sown in the first week in January to give the plants as long a season as possible before the time of the show. A suitable compost is as follows: 3 parts sifted loam, 1 part leaf-mould, a little well-rotted manure, a sprinkling of sand.

Use 6-inch pots and fill to within 1 inch of the top with the compost; sow the seed thinly and cover lightly. Place a piece of glass over, and a piece of paper on the glass to prevent excessive evaporation. Put the pots in a warm greenhouse or on a hotbed. Lift the glass and wipe the moisture off it every night. As soon as the little plants appear above the soil, the glass and paper may be removed, and the pots placed as near the glass of the roof of the greenhouse or frame as possible. When the second leaf is about ½ inch long, the plants should be shaken out of the compost, and pricked off into boxes in rows 2 inches apart, and 2 inches between the plants in the rows. The compost for the boxes may be similar to that for the seed pots, adding 1 part of well-rotted manure. Place the boxes in the greenhouse or hotbed again. As the weather improves the plants should be gradually hardened off, until, by the beginning or middle of April, they should be hardy enough to be placed outside in a position protected from cold winds by a wall or hedge.

Preparing and Planting the Bed.—This should be done from the middle to the end of April.

If the soil has been left rough it should be levelled, and sprinkled with soot and raked over, making it very firm by treading, and again raking it over. The seedlings should be planted in rows 1 foot apart, and 1 foot apart in the rows.

When planting make a good deep hole with the trowel, to allow the roots to be put in quite straight, the base of the plant to be about ¼ inch below the surface of the soil. When they have made some growth, the soil round them may be removed with the finger, to allow the bulbs to expand freely. Feed with liquid manure once a fortnight, or two or three top dressings of 1 lb. of nitrate of soda or sulphate of ammonia may be applied throughout the season. A top dressing of super-phosphate may be given early in June. The soil should be frequently stirred with the hoe. Prevent the attacks of the onion fly. (See article in Vol. III.)

Feeding should stop by the middle of July (except for the heaviest onions) and the bulbs be allowed to ripen. Twist the necks and lay them over, in the first or second week in August. The plants should be loosened in the soil a fortnight before the show, and a week after loosening they may be lifted and turned over to thoroughly ripen. If the weather is showery they should be placed in a frame, or under cover, fully exposed to the sun.

Varieties: Selected Ailsa Craig, Cranston's Excelsior, Golden Globe, Sutton's A1.

Shallots.—When Shallots are exhibited in clusters, these should be formed of ripe, firm cloves or bulbs. If exhibited singly, the cloves should be large and have clear skins.

A medium soil, fairly richly manured, is suitable for Shallots. Towards the end of February the cloves should be planted singly 6 inches apart, in rows 1 foot apart. These will form large clusters by autumn. In each case the cloves should be set firmly in the soil with their tips just showing. When the foliage turns yellow, the bulbs should be lifted, thoroughly ripened in the sun, and then stored in a frost-proof shed.

Varieties: (Large) Sutton's Giant, Large Red Selected.

Leeks.—Exhibition Leeks should be uniform in thickness, and clear in skin, with

a long blanched neck. They take from eight to nine months to complete their development. Seed should be sown in the first week in January, in a flower-pot or box, and treated in the same way as advised for Onions. When the seedlings have formed a second leaf, shake them out of the soil and pot them up singly into 3-inch pots, and return them to the greenhouse or hotbed, gradually hardening them off until, by the middle of April, they should be ready for planting out. For this a trench, 2 feet deep and 18 inches wide, should be dug, and a layer, a foot thick, of fresh horse manure placed in the bottom of it, treading it fairly firmly; this should be covered with 8 or 9 inches of good loamy soil mixed with well-rotted manure. Set out the plants 1 foot apart. The fresh horse manure in the bottom of the trench will ferment and give off considerable heat, and this will start the plants quickly into growth. It will have decayed by the time the roots grow down into it, and they will thus get plenty of food.

Blanching.—As soon as the plants are high enough, strips of stout brown paper 3 or 4 inches broad should be wound round each plant two or three times and tied round the middle. When the growing centre of the plants is well above the paper collars, the collars should be drawn up, and leaf-mould or soil placed inside the boards round the plants. The collars should be drawn up as the centre of the plants grow above them, and more leaf-mould or soil placed round the necks. As the plants grow in thickness wider collars must be put on. The collars must extend only a little above the growing centre of the plants. Blanching should be done gradually, so as to allow the plants to grow in thickness. When they have become well established, liquid manure should be given once a week, weak at first, stronger as growth proceeds. Liquid manure is obtained from the farm, or by placing ½ bushel of poultry or cow manure in a barrel and filling it up with water, stirring it round, and allowing the sediment to settle before the liquid is used. If boards and leaf-mould are not available, ordinary garden soil may be placed round the base of the plants as the paper collars are pulled up. Two-inch drain-pipes should be placed upright between the plants in the row as the soil is built up, and liquid manure is applied by pouring it down the drain-pipes. Five stout canes should be put in at each end of the row of Leeks, sloping outwards, and two or three lines of stout cord stretched along each side of the row. The leaves should then be tied loosely to prevent their being blown about and broken by the wind. It is not advisable to blanch Leeks too quickly or to carry on blanching too long. Allow the plants to grow in thickness as they grow in length; and when they have been blanched to 12 or 14 inches, encourage them to develop in thickness. It is better to have a fairly thick Leek with 12 to 14 inches blanched than to have, say, 16 inches blanched with less thickness.

Varieties: Dobbie's International Prize, Sutton's Prizetaker.

Celery.—Celery requires to have large, shapely heads, well blanched, the leaf stalks fleshy and solid. It takes seven to eight months to grow into first-class "sticks". Seed should be sown in a shallow box in February, using the same compost, and treating it in the same way as advised for Onions. Never allow the soil in which Celery is growing to become dry, or many of the plants will run to seed. When the young plants have formed a leaf after the seed leaves, they should be pricked out into boxes (using a similar compost to that advised for pricking out Onions) in rows 2 inches apart, and 2 inches between the plants in the row; place the boxes again in a warm part of the greenhouse or hotbed, and when the plants have made some growth, air should be admitted freely, gradually hardening the plants, until by the middle of May they may be placed outside in the boxes. As the plants become well rooted, plenty of water must be given. Planting out should not be done before the end of May.

Dig out a trench as advised for Leeks, and put in 1 foot of fresh horse manure. Tread this down, and cover with 6 inches of good loamy soil mixed with well-rotted farmyard manure.

Place a single row of plants in the centre of the trench, 1 foot apart, and give a good watering after planting. The heat rising from the fermenting horse manure will cause the plants to start with vigour. Liquid manure should be given once a week after the plants have become established. It should be weak at first, stronger as the plants get older.

Blanching,—Exhibition Celery should be blanched by wrapping brown paper round the plants. By this method the plants may be examined from time to time, as new

papers are put on, and the blanched part will be pure and clean.

When the plants have made considerable growth, and the growing centre is 3 or 4 inches high, the plants should be gone over, and all the short leaves and any side shoots, which may have formed round the base of the plants, removed. Strips of brown paper 4 to 6 inches broad should be wrapped round them, firmly but not tightly, and tied near the top and bottom. When the plants grow above the paper collars, broader ones should be substituted, but care must be taken not to use too deep collars, which would shut out air and light from the foliage.

It is not advisable to hurry the blanching, nor to carry it on too long. As in Leeks, the plants should be allowed to grow in thickness as they grow in length.

Each time the paper collars are removed, the plants should be carefully examined for earwigs, slugs, or other pests. A look out should also be kept throughout the season for the leaf miner.

Varieties: Dobbie's Selected Red, Sutton's Superb Pink, Invincible White.

Spinach.—This vegetable is grown for its fleshy leaves. For exhibition purposes the leaves should be large, thick, and dark-green.

A medium soil is suitable, and it should be deeply cultivated and heavily manured.

The first sowing may be made in February, and repeated fortnightly as long as desired. Sow the seed roughly, an inch apart, in drills 1 inch deep and 18 inches apart. When the seedlings are about 2 inches high, they should be thinned out to 2 or 3 inches apart, for exhibition purposes to 6 inches apart, to give the plants room to develop.

When Spinach is required for a certain date, two sowings should be made. If the weather is warm, the first sowing may be too early, but the second sowing may provide the finest plants. If it is cold, the first sowing may produce the best plants.

Varieties: Victoria, Improved Round, Sutton's Long-standing Round.

Parsley.—Exhibition Parsley should be finely curled and firm to the touch.

The soil should be well cultivated, and fairly well manured. The seed should be sown thinly in a flower-pot, using the same compost as advised for exhibition Onions. Place the pot in a warm part of the greenhouse or hotbed. As soon as the little plants appear above the soil, place the pot as near the glass of the greenhouse or frame as possible, to ensure sturdy growth. When they have formed the first true Parsley leaf, they should be potted singly in small pots and returned to the greenhouse or hotbed; later they may be transferred to a cold frame, and by the end of April removed from the frame to the open ground. They should be fit to be planted out in May, in rows 18 inches apart.

The centres of the plants should be well filled with big, nicely-curled leaves, giving a full and rounded appearance.

Sometimes a fine plant may not be well filled in the centre; this may be remedied by fixing a good big pane of glass about 3 or 4 inches above the plant on four small pegs. The glass will draw up the centre leaves.

Varieties: Dobbie's Exhibition, Austin's West of Scotland Prize.

Lettuces.—Firm hearts, tender and of good size, are the points of exhibition Lettuces. The soil should be well cultivated, and heavily manured with farmyard manure. The time of sowing is important, as the plants do not remain in good condition long after the proper stage is reached. It takes from ten to twelve weeks from the time of sowing until the plants are full grown. As the period will vary with the season, a second sowing is advisable. Sow the seeds, three or four together, at intervals of 9 inches in drills, which should be 15 inches apart and 1 inch deep. When the plants are 1 inch high, they should be thinned, leaving the best plant of each clump to develop. If the season is dry, and especially in light soils, a mulching of well-rotted manure should be given; this induces rapid growth and the formation of hearts of crisp leaves. If the Cos varieties do not turn in, they may be tied.

Varieties: Cos—Sutton's Mammoth White, Sutton's Peerless, Dobbie's Exhibition Cos, Austin's Mammoth White; Cabbage—Dobbie's Exhibition Cabbage, Sutton's Ideal, Dobbie's Lemon Queen, Sutton's Matchless.

Endive.—Large hearts, well blanched and crisp, are essential in exhibition Endive. They grow best on a light soil, heavily manured and deeply dug.

Sow the seeds, three or four together at intervals of 12 inches, in drills 15 inches apart, and treat as advised for Lettuces. They take from twelve to fourteen weeks to reach maturity.

To blanch them, cover with large flower-

pots with a piece of stone placed over the hole on the top of the upturned pot, or with boxes a fortnight before the show.

Varieties: Curled—Sutton's Exquisite Curled; Round-leaved—Veitch's Improved Round-leaved.

Radish.—Young tender roots of medium size and bright colour are desirable for exhibition.

The soil should be light, rich, and deeply cultivated, and successional sowings be made every fortnight. A warm sunny border is best for spring sowings, but in summer a cool, partially shaded position should be selected.

The seed should be sown thinly, and the plants afterwards thinned to about an inch apart. Plenty of water is necessary to ensure solid, tender roots.

For an early spring crop, use a hotbed of fresh horse manure, covered with about 4 inches of soil, and sow the seed broadcast on this. In cold weather the frame should be covered with a mat.

Varieties: Olive—Sutton's Early Rose, French Breakfast; Turnip-shaped—Sparkler, Sutton's Red White-tipped; Long—The Sutton Radish, Long Scarlet.

Preparation of Produce for Showing

For show purposes it is not enough to grow fine specimens of vegetables; it is essential to know how to prepare them and set them out, in order that their good qualities may be seen to advantage. They must be harvested and handled with the greatest care, and each kind must be treated in the special way required.

Potatoes.—In lifting, the fork must not be allowed to touch the tubers. It should be used merely to loosen the soil, and the Potatoes should then be lifted by hand and carefully washed.

Carrots.—A trench, deep enough to reach the tips of the roots, is dug parallel to the row, and a few inches from it. The earth is carefully removed, and the plant can then be lifted without fear of injuring the tip. The leaves are cut off from 1½ to 2 inches above the crown, and the roots carefully washed so that the tender skin is not broken.

Beetroot.—This should be lifted in the same manner as Carrots. The leaves are cut off 2 inches above the crown, which must not be injured or it will bleed. The roots are carefully washed, and the small fibrous roots neatly cut off.

Parsnips.—Parsnips should be dug up in the same way as Carrots. The leaves should be cut off 2 inches above the crown. The roots should then be washed, care being taken not to injure the skin.

Turnips should be pulled up carefully to keep the tap-root intact; they should be washed clean. The leaves should be cut off close to the crown without injuring it. The tap-root must not be removed or injured.

Cabbages with firm hearts should be chosen. They should be cut carefully with all the outside leaves intact. None of these should be removed, and the greatest care should be taken not to break them, or to rub off the "bloom" which covers the leaves of well-grown Cabbages.

Savoys should be prepared in the same way as Cabbages.

Brussels Sprouts.—For exhibition on the stalk, select straight stems, well covered with medium-sized, close, fine Sprouts. The stems should be cut as low as possible, and the leaves should be cut off close in to the Sprouts, so as to show them to the best advantage. If the Sprouts are to be shown off the stems, good-sized, firm Sprouts should be selected, and any small loose leaves round the base removed, leaving the Sprouts quite clean and solid.

Kale are always shown as heads. Plants with finely-curled leaves, and full in the centre, should be chosen; they should be cut low down, care being taken not to injure any of the leaves. Leaves which are beginning to turn yellow should be removed.

Cauliflower.—Well-formed, close, pure white heads should be selected. They should be cut low down, and the leaves cut off level with the top of curd so as to form a green collar round it; any small green leaves which are curving over the curd should be removed to expose its form.

Peas.—Large, well-filled pods should be selected, and the greatest care should be taken in picking them. They are best cut off with a pair of scissors, leaving the stalk attached to the pod. By taking this precaution, the "bloom" will not be rubbed off the pods.

Broad Beans.—Large, finely-shaped, well-filled pods should be chosen. They should be carefully handled so as not to injure them or to rub off the bloom.

French Beans.—Long, finely-shaped pods should be chosen. They must be just fully grown, but still crisp and brittle. One

or two may be tested, to see which pods are in the best condition for picking. They should be carefully handled.

Runner Beans.—These should be treated in the same way as French Beans.

Onions exhibited for quality must be thoroughly ripened. They should be well shaped, with thin necks. The roots should be removed close to the base of the bulb, and the top cut off about 2 inches above the bulb. Any loose membranous scales may be removed, but on no account must any of the thick scales be taken off, as the bulbs would then be spoiled, from an exhibition point of view. If the bulbs have been well ripened, the skin should be clean and firm when the loose scales are removed. Heavy Onions should be allowed to grow until the morning of the show. The roots only should be cut off, and the bulbs carefully washed, removing only those leaves which have ripened and would spoil the appearance of the exhibit.

Leeks.—Large straight Leeks, without any bulbous swelling at the base, should be preferred. Dig them up with care, so as not to injure the long leaves or the blanched portion or stem. The roots should be cut off about 2 inches from the base of the plant. There should be no need to remove any of the leaves. The plants should then be washed. A piece of raffia should be tied round the base of the leaves, at the top of the blanched portion, to keep them together. A strand run across between the leaves will prevent the raffia from slipping down.

Celery. — Large, well-blanched, clean heads should be chosen. The plants should be carefully examined to see that they have not begun to "bolt". This can be done by separating the leaf-stalks slightly so as not to break them. The centre should be made up of young leaf-stalks. If it is a solid round stem, the plant has begun to form the flower stem, and must be discarded. The leaf-stalks should be tied firmly just under the green leaves, the roots cut off, cutting into the root-stock by downward cuts, leaving it cone shaped, and then carefully washed.

Parsley.—The plants must be well formed, full, and very finely curled. Lift them on the morning of the show with a good ball of soil attached to the roots; it may be reduced carefully to fit the pot. A 6- to 8-inch pot should be selected, according to the size of the plant or the requirement of the show. The plant should then be potted, and well watered, the foliage being sprinkled to keep it fresh. Care should be taken not to break any of the leaves.

Lettuce.—Large plants with firm hearts should be pulled up, without injuring the outside leaves. Remove only those leaves which have begun to turn yellow, leaving the large healthy outside leaves attached to the plants. Wash the soil from the roots, but leave them on the plant.